March 1983
vol 9, no 3
$2.95

creative computing®

the #1 magazine of computer applications and software

New Computers: Apple IIe, Epson HX-20

In-depth Evaluations:

- ☐ 14 Printers
- ☐ Microfazer
- ☐ Word Processors for Color Computer
- ☐ Color Computer Disk Drive
- ☐ Data Factory
- ☐ Color Computer Games
- ☐ TRS-80 Games
- ☐ Paint

Columns:

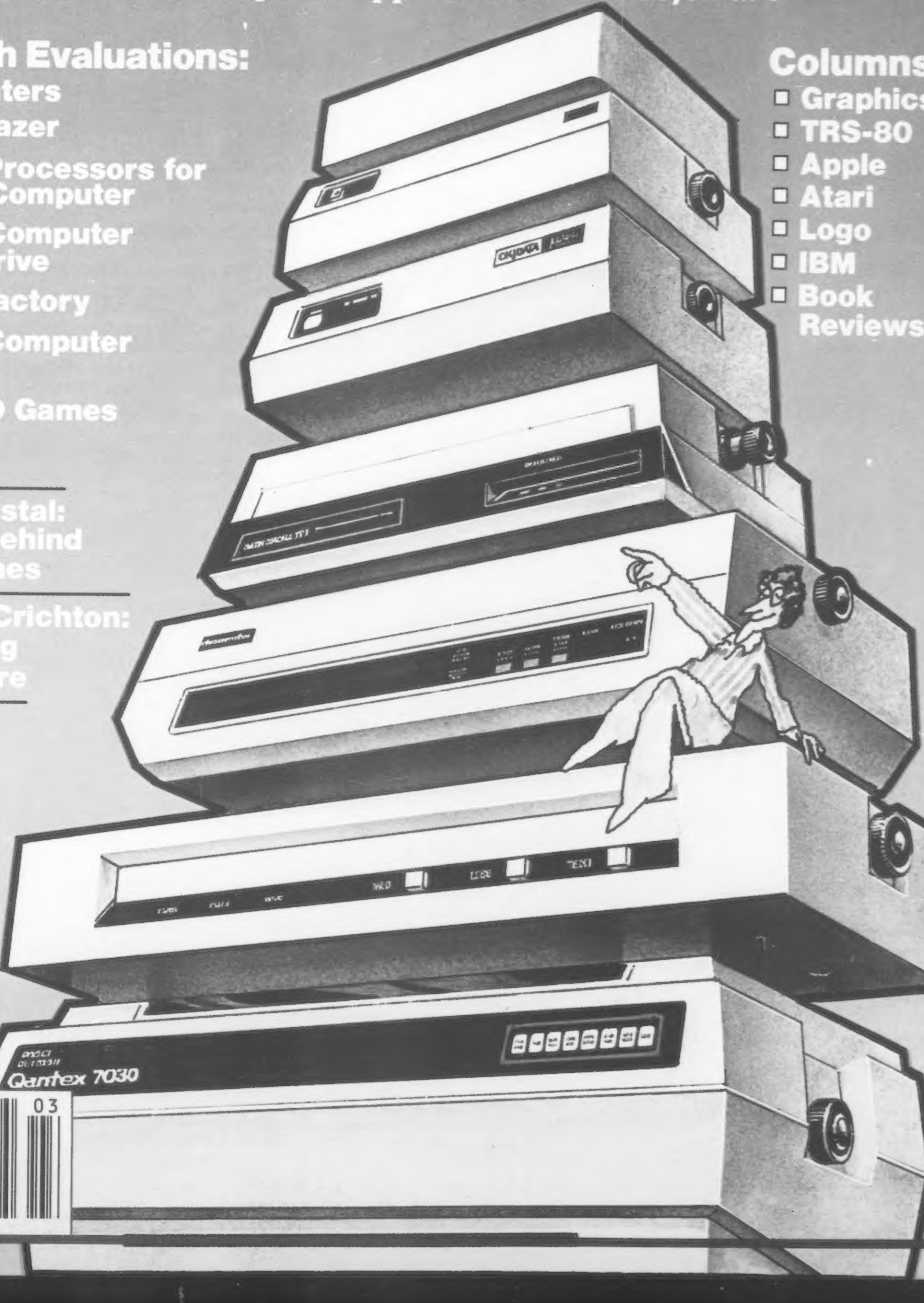
- ☐ Graphics
- ☐ TRS-80
- ☐ Apple
- ☐ Atari
- ☐ Logo
- ☐ IBM
- ☐ Book Reviews

Dark Crystal: A Look Behind The Scenes

Michael Crichton: Predicting The Future

Home Library Catalog Program

TRS-80 Graphics



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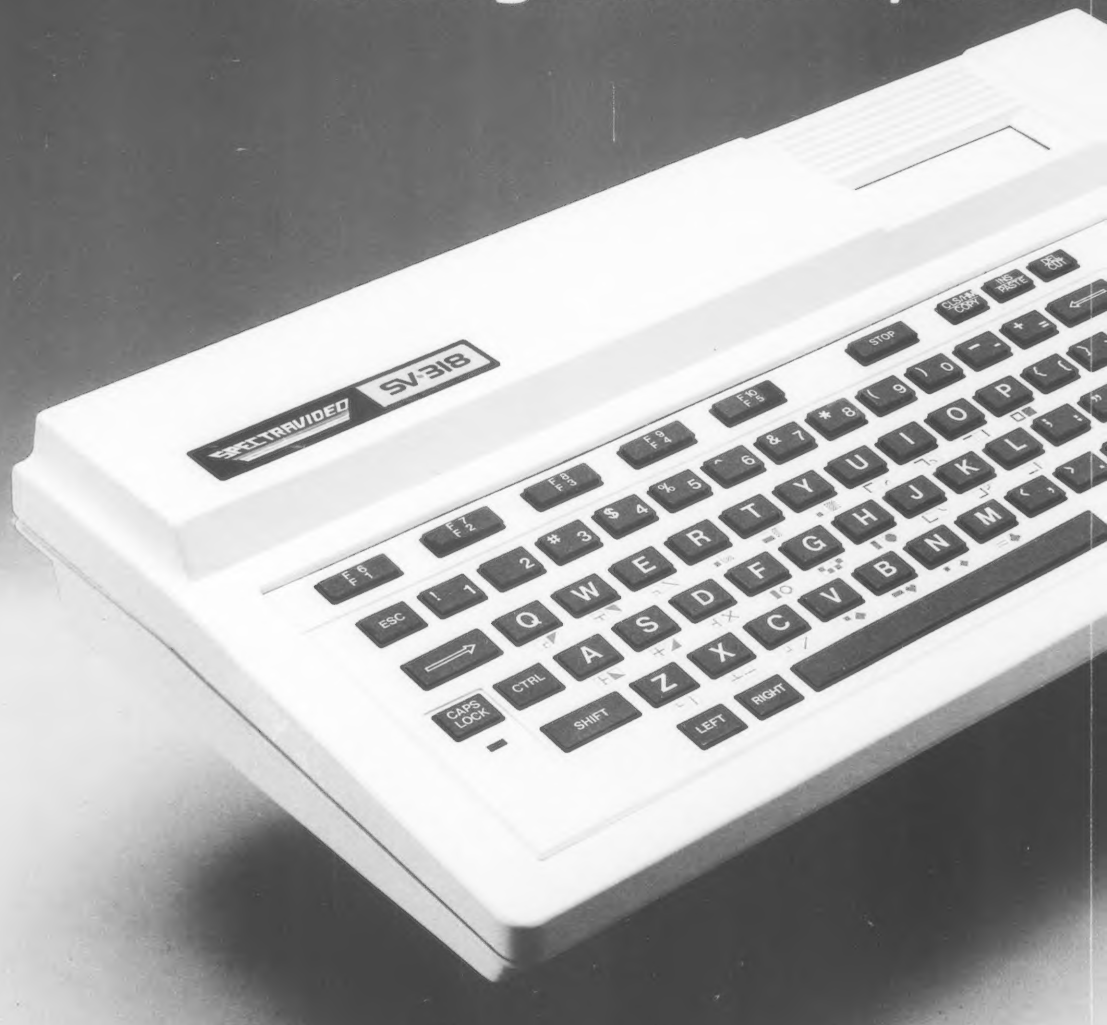

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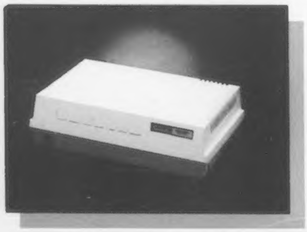

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and data stored. The data cassette will
be an integral part of your system even
choose to expand into a disk drive. The
cassette even has a built-in condenser
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SPECTRAVIDEO SV-318 COMPUTER COMPARISON CHART

	SPECTRAVIDEO SV-318	APPLE II PLUS	ATARI 800	COMMODORE 64	NEC 6001	RADIO SHACK COLOR COMPUTER
BASE PRICE	$299	$1,540	$899	$595	$399	$299
COMPUTING POWER FEATURES						
BUILT-IN ROM	32K	12K	10K	20K	16K	8K
EXPANDABLE TO	96K	N/A	42K	N/A	32K	16K
BUILT-IN EXTENDED MICROSOFT* BASIC	YES	YES	ADDITIONAL COST	NO	YES	ADDITIONAL COST
BUILT-IN RAM	32K*	48K	16K	64K	16K	4K
EXPANDABLE TO	144K**	64K	48K	N/A	32K	16K
KEYBOARD FEATURES						
NUMBER OF KEYS	71	51	61	66	71	55
USER DEFINE FUNCTIONS	10	N/A	4	8	10	NONE
SPECIAL WORD PROCESSING	YES	NO	NO	NO	NO	NO
GENERATED GRAPHICS (FROM KEYBOARD)	YES	NO	YES	YES	NO	NO
UPPER/LOWER CASE	YES	UPPER ONLY	YES	YES	YES	YES
GAME/AUDIO FEATURES						
SEPARATE CARTRIDGE SLOTS	YES	NO	YES	NO	NO	NO
BUILT-IN JOYSTICK	YES	NO	NO	NO	NO	NO
COLORS	16	15	128	16	9	9
RESOLUTION (PIXELS)	256 x 192	280 x 160	320 x 192	320 x 200	256 x 192	128 x 64
SPRITES	32	N/A	4	8	N/A	N/A
SOUND CHANNELS	3	1	4	3	3	1
OCTAVES PER CHANNEL	8	4	4	9	8	10
A.D.S.R. ENVELOPE	YES	NO	NO	YES	YES	NO
PERIPHERAL SPECIFICATIONS						
CASSETTE	2 CHANNEL	1 CHANNEL	2 CHANNEL	1 CHANNEL	1 CHANNEL	1 CHANNEL
AUDIO IO	YES	NO	YES	NO	NO	NO
BUILT-IN MIC	YES	NO	NO	NO	NO	NO
DISK DRIVE CAPACITY	256K	143K	96K	170K	N/A	170K
(LOW PROFILE)	YES	NO	NO	NO	NO	NO
CP/M* COMPATIBILITY (80 column programs)						
CP/M* 2.2	YES	NO***	NO	NO ****	NO	NO
CP/M* 3.0	YES	NO	NO	NO	NO	NO

SSETTE

ette draws its
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ead, you can record
e or sound on the
e usage of cassette
foreign language
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** 128K user addressable plus 16K graphic support
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**** Commodore 64 accepts 40 column CP/M

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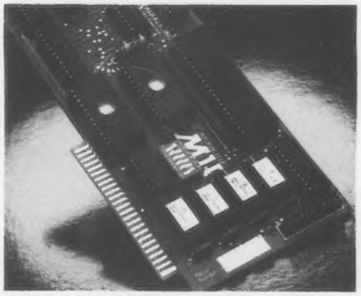

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Other Microbuffer models include Microbuffer/E for Epson printers and a stand-alone, in-line Microbuffer unit to untie virtually any computer/printer combination.

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issue...in this issue...in this

evaluations & profiles

Printers and Word Processing

12 **Buying A Printer**.................................. *Ahl*
How to decide which one is for you

30 **Printer Evaluations**........... *Anderson and Linzmayer*
We evaluate and rate 14 printers

64 **Microfazer From Quadram**......................... *Ahl*
Data buffer saves time

72 **Printer Update**............................ *Linzmayer*
Newest printers on the market

81 **Word Processing With Apple, Diablo And WordStar**................. *Mar*
Some do's and some don'ts

89 **Three Word Processors For TRS-80 Color Computer**.................. *Norman*
Telewriter, C.C. Writer and Color Scripsit

101 **Epson HX-20**..................................... *Ahl*
Good things come in small packages

116 **Apple IIe**.................................. *Goodman*
A firsthand examination

132 **Color Computer Disk Drive**..................... *Steiner*
Getting serious with the Color Computer

136 **Data Factory**............................... *O'Rourke*
Foolproof, flexible database management

144 **Electronic Canvas**.......................... *Anderson*
Paint, a graphics composer for the Atari

152 **TRS-80 Arcade Games**...................... *Linzmayer*
Six of the best we've seen

160 **Color Computer Games**.................... *Linzmayer*
Bugs, spaceships and raquetball for the Color Computer

Cover illustration by Pat Ruggero.

March, 1983
Volume 9, Number 3

Creative Computing (ISSN 0 097-8140) is published monthly by Ahl Computing, Inc., a subsidiary of Ziff-Davis Publishing Company. David Ahl, President; Elizabeth B. Staples, Vice President; Selwyn Taubman, Treasurer; Bertram A. Abrams, Secretary. P.O. Box 789-M Morristown, N.J. 07960. Second Class postage paid at New York, NY 10001 and at additional mailing offices.

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Editorial offices located at 39 East Hanover Ave., Morris Plains, NJ 07950. Phone (201) 540-0445.
Domestic Subscriptions: 12 issues $24.97; 24 issues $43.97; 36 issues $57.97.
POSTMASTER: send address changes to Creative Computing, P.O. Box 5214, Boulder, CO 80321. Call 800-631-8112 toll-free (in New Jersey call 201-540-0445) to order a subscription.

articles

168 **The Dark Crystal**............................ *Anderson*
A look behind the scenes

178 **How To Solve It**................................ *Piele*
Beyond turtle graphics

187 **Logo Ideas**..................................... *Lawler*
Variables and Abstraction

applications & software

188 **Predicting The Future**........................ *Crichton*
A program to cast the I Ching

204 **TRS-80 Graphics Made Almost Painless**.......... *Crew*
Part two: vector plotter

214 **Computer Art For The Tektronix**.............. *Jacobson*
Sinusoidal loop no. 2

216 **Library Catalog**.............................. *Hellman*
Create a computer based home library catalog

departments

6 **Input/Output**................................. *Readers*

8 **Notices**.. *Fee*

10 **Seven Years Ago**................................. *Ahl*

258 **Graph Paper**.................................... *Lubar*
Part nine: the wrap-up

265 **New Products**.................................... *Staff*

272 **Apple Cart**..................................... *Adams*
A speech synthesis program

276 **Outpost: Atari**............................. *Anderson*
Light pens to buy and make

284 **IBM Images**.................................... *Fastie*
Most frequently asked questions answered

294 **TRS-80 Strings**................................... *Gray*
Spectrums, spirals and Tandyvision

300 **Book Reviews**..................................... *Gray*

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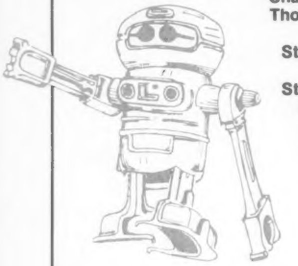

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CIRCLE 167 ON READER SERVICE CARD

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A Small Disagreement

Dear Editor:

I disagree with a statement which appeared in the August, 1982 issue in the column "Outpost: Atari."

David and Sandy Small were discussing the speed of the Atari disk drive. They stated that the serial bus cable and the write-with-verify slowed down the disk drive access. They recommended turning off the read-after-write feature of DOS.

The Smalls state that they have never had an error message that means the read-after-write failed.

They stated that many of their associates have had errors, but only on defective disk drives. I find this hard to believe. It may be that errors have occurred to the Smalls, but DOS was able to recover, which means that an error message would never be displayed. The Smalls also stated that the time spent waiting for the Atari to verify data just isn't worth it. *This is not true.*

As with many features of the Atari hardware and software, the DOS was designed to be easy to use and as transparent as possible. By providing automatic error detection and correction logic to DOS, this has been accomplished. DOS will retry I/O operations 10 times. If the problem still is not corrected on the tenth try, then an error message is displayed.

Atari includes a section in their manual which tells you how to turn off the read-after-write feature, but the Smalls are wrong in recommending this practice to unsuspecting users.

If the Smalls never have problems with their disk files, then they are either very lucky or don't do a large amount of writing to disk.

Bob Duke
1619 - 71st St.
Darien, IL 60559

Munching Out

Dear Editor:

While Robert Cashman has described Munch Man in fine style, I would like to offer him and other users of this TI game directions to access the Test Model/which should provide (provoke) even greater enjoyment.

To access the Test Mode, you have 3-seconds from the time the Munch Man screen appears to type *#*. (Hint: When the screen says, "Press any key to begin," hold the Shift key down and type 8, 3, 8//*#*).

You know when you're in the Test Mode when the screen changes and the *first* prompt asks which round you'd like to play in. When "RND(0-2)" appears on the screen, type either 0, 1, or 2.

The *second* prompt asks you which screen you'd like to play. When "SCN(0-19)" appears, type your choice (from 0 through 19).

The *third* (and, last) prompt asks you for the number of Munch Men you'd like to play with.

When "MM(1-9)" appears, type your choice (from 1 through 9). Note: the computer expects you to type "9" and has strategy to deal with this choice as you'll quickly learn.

These three-prompts appear on the *same* screen in the order described. Be quick about typing your choices for the three-prompts or the timing will advance the game automatically for you.

And, for those who have difficulty counting (as initially I did) remember that for the first- and second-prompts, 0=1!

As long as you "win" at any level the game continues to the next higher level screen (a total of 60). Whenever you do NOT win, Munch Man automatically reverts to the first-screen—or, if you want to access any higher levels, you repeat the procedure to access the Test Mode.

When you "play" the 20th-screen (type *19*, please), be prepared. Irrespective of the Round (RND 0, 1, or 2) chosen, you'll be at the supercalifragilisticexpialidocious level!

J. L. Vaughn
Texas Instruments Product
Support Representative
116 N. 8th St.
DeKalb, IL 60115

A Pound of Cure

Dear Editor:

A few months ago I wrote to you, to tell your readers that I was interested in compiling a book of listed programs for use in Microcomputer Applications in Medicine. You kindly published the letter. I had no idea of the response that might deluge me. I received letters from all parts of America, Canada, South America, Europe, Israel, South Africa and even a letter from China. There were early morning phone calls, picture postcards, packets of discs, bundles of listings, it was a tremendous response.

Several publishers wrote or telephoned me stating their interest in publishing the book.

The outcome is that the book is now published by Medical Software Co., Box 874, Center Moriches, New York 11934, price $80.00

The volume contains medical application programs for patient scheduling, record retrieval, simple billing, utilization of equipment, simple statistics; standard deviation calculations and curve fitting routines.

Programs are still coming in and are being reviewed for the second volume which should be ready in April 1983. I want to thank everyone again for the tremendous response.

Derek Enlander, M.D.
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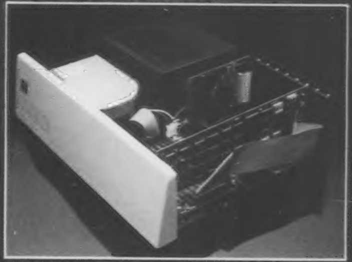

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CIRCLE 274 ON READER SERVICE CARD

Source Code for Authoring Languages

I would like to thank the many people who have written me concerning my Pilot-to-Basic translator. As I discussed in my article the translator was created to provide teachers at a teachers' convention with a hands-on introduction to Pilot and not as a full version of Pilot.

Many of the writers have asked for information concerning source code to allow Pilot to run on other machines. The following is a list of the information on some suppliers. Since I have had no opportunity to review their products, I am unable to make any comment on the various implementation.

Free or Nearly Free

These versions of Pilot are translator programs that take Pilot and turn it into either Pascal or Basic. They do not support storage of student information.

1. Pascal version of Pilot. Program given in July 1980 *Byte* article called "Pilot/P: Implementing a Language in a Hurry" by D. Mundie.

2. Apple version of Pilot. Program published in *Creative Computing*, October 1982 and on in article called "Pilot-to-Basic Translator" by M. Smith.

Send $5 plus a disk and a SASE (or $2.50 postage) to:

M. Smith
304 - 86th Avenue S.E.
Calgary, Alberta
Canada T2H 1N7

3. Apple/Atari version of Pilot. Programs published in September through November 1982 *Compute!* in articles called "Turtle Pilot" by A. Poole.

Send $3 plus a disk and an SASE to:

Alan Poole
4728 King Rd.
Loomis, CA 95650

Commercial Sources

. These appear to be full versions of Pilot or Pilot-like languages.

1. Cast—written in C and supported under the Unix operating system. Documentation seems to indicate that the license for use includes the source code. Cost, $795 plus relevant taxes and handling.

David Clark
UNIX Application Manager
Measurement Concept Corporation
1721 Black River Boulevard
Rome, New York 13440
(315) 337-1000

2. Pascal source code (UCSD). Has been successfully used on DEC and CDC according to advertisements. Cost, $495 plus relevant taxes and handling.

George Gerhold
MicroPi
P.O. Box 5524
Bellingham, WA 98227
(206) 733-9265

3. IBM compatible assembly language code—can be customized to any IBM 360/370/4300 compatible system and any time-sharing monitor (such as TSO) according to advertisements. Requires installation by a system programmer. Cost, $495 plus relevant taxes and handling.

George Gerhold
MicroPi
P.O. Box 5524
Bellingham, WA 98227
(206) 733-9265

There are probably many other sources, so ask the manufacturer of your favorite flavor of Pilot. If those manufacturers would drop me a line, I would be more than willing to generate an article describing their products and comparing the described features, especially in the area of graphics and user documentation. Send the information to:

Dr. M. Smith
Department of Electrical Engineering
The University of Calgary
Calgary, Alberta
Canada T2N 1N4

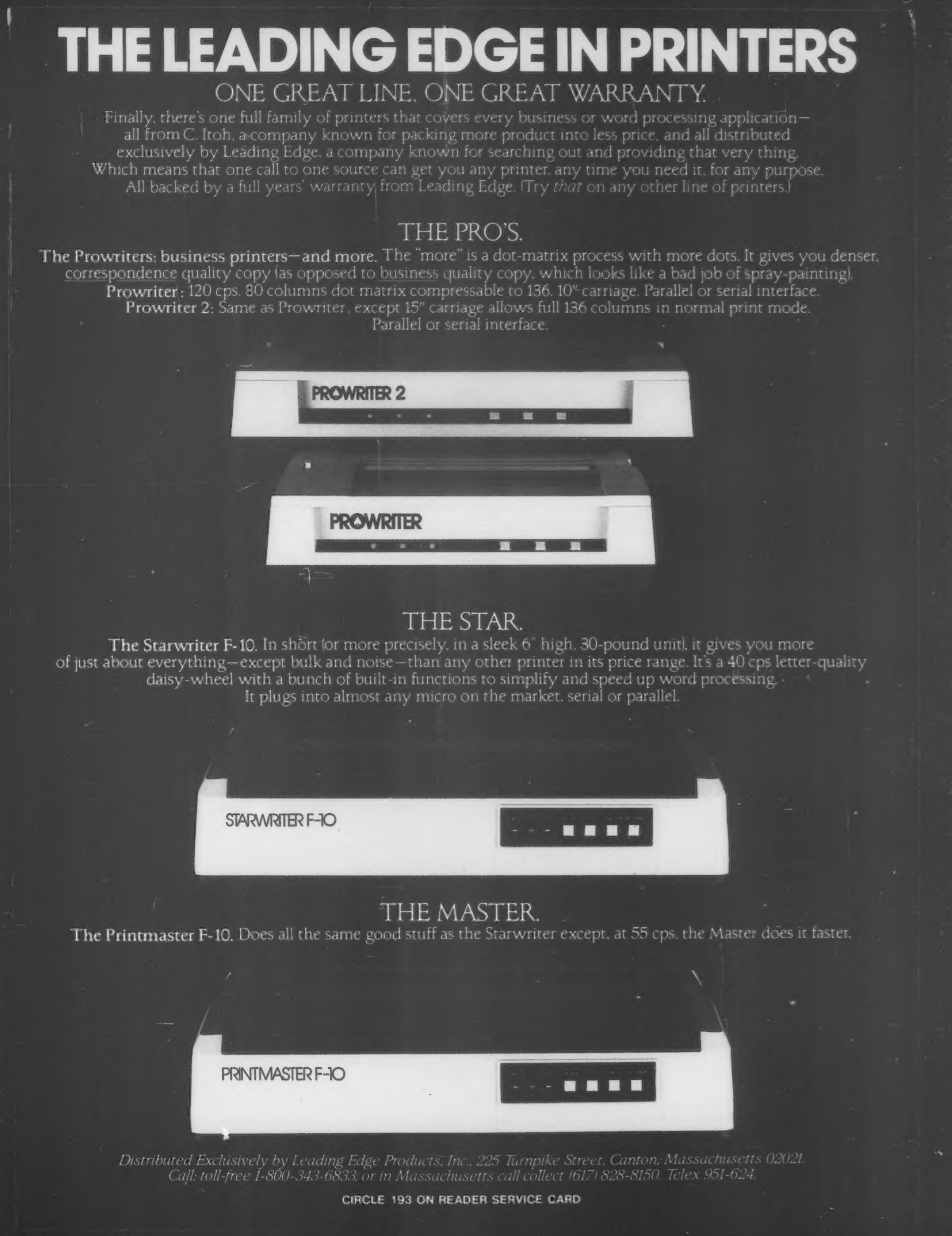
Common Pilot Users Group

This is a group interested in the development of C.A.I. using Pilot as a medium. Provides a list of all members. Contact:

Larry Kheriaty
CPUG
Computer Centre
Western Washington University
Bellingham, WA 98225
(206) 676-3501.

—M.R. Smith

ADMINI STRATION
FIRST AID



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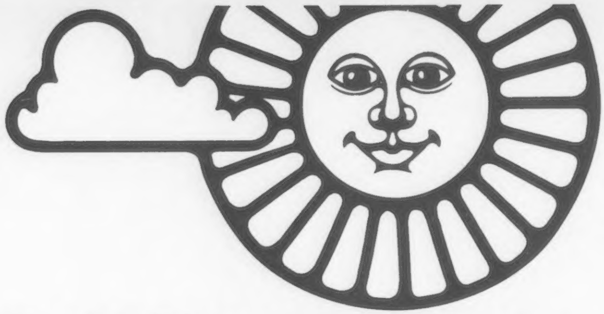

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7 Years Ago in creative computing

The lead article in the January 1976 issue was titled "Building A MITS Altair 8800." We noted that we got into trouble because the solder pads were too close together on the PC board and because of the 66 wires which must be soldered one-by-one to the display/control board. We criticized MITS for providing only two programs, one to add and the other to multiply binary numbers.

Despite our criticism of the Altair we concluded that "unless some other company can fight this already well-established computer kit with a bigger and better advertising campaign (and not necessarily with a better computer kit), then the 8800, the 680 and future Altair computers will give MITS the micro-equivalent of IBM's continuing and overwhelming success."

We had an article, "Beating the Game" which discussed Edward Thorp's card counting system for playing blackjack. This was years before Ken Uston used a similar method to win millions in Las Vegas and Atlantic City.

An article on magic squares showed how to construct n x n squares with many different properties.

A section on computer chess discussed different techniques and a tough match played between International Master David Levy and a program called Ostrich which runs on a CDC Cyber 175. Levy finally won.

A huge 15-page section of the issue had 107 puzzles and problems, many of which were suitable for computer solution. And the issue had seven challenging games including Wumpus-2, Chase and Roadrace.

The back cover ad was for the MITS Altair 680 ($345 for the kit with 1K of memory). At the other end of the spectrum was an ad from Educomp for a DEC PDP-8 multi-user system for $31,240.

Our new products section had announcements of three new magazines, *Computer Notes, The Computer Hobbyist*, and *Byte*. Although some people consider *Byte* the grandaddy of personal computing magazines, *Creative* predates *Byte* by nearly a year. ☐

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Hardware requirements: Apple version requires Apple II or Apple II + with 48K and Applesoft in ROM of language card, DOS 3.3. Atari 400/800 version requires 48K and BASIC cartridge. Both versions require only one disk drive.

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CIRCLE 117 ON READER SERVICE CARD

Buying a Printer

David H. Ahl

Background

Back in 1976, we did our first printer review for the January 1977 issue. It was of the Teletype Model 43 terminal. In those days, selecting a printer wasn't too difficult. You either bought a used Teletype ASR-33 (upper case only, clunk, clunk, clunk), a new Teletype 43 (dot matrix, buzz, buzz, buzz) or you jury-rigged something between your computer and a used printer from a mini or mainframe.

By the time we did our first printer roundup (December 1979), it was getting more difficult to choose a printer. Both dot matrix and fully-formed character units were available in a price range attractive to the personal computer user. Nevertheless, prices were high by today's standards. The least expensive printer on the market was the Integral Data IP125 at $799, and from there the prices rose quickly to $2995 for a Qume Sprint 5.

Subscribers to *Creative* will remember that our review was quite critical. Qume wouldn't talk to us for ages after the review appeared and Malibu wasn't too happy either. Qume has its act together today and the Sprint 5 that we berated in 1979 is still in daily service. One could conclude that it has passed the test of time.

Those of you who have followed our printer reviews over the years have undoubtedly noticed two things. First, the reviews have never pulled any punches. We feel our first responsibility is to the reader and, in the long run, honest, in-depth reviews are in the best interest of everybody—even though some manufacturers might be temporarily upset. Second, choosing a printer is an increasingly complicated task.

Part of the reason the choice of a printer is so complex is that the choice is so wide. Today over 90 printers are available in the under $5000 range, and 75 can be had for $3000 or less. Indeed, narrowing the field to units under $1000 still gives one a choice of 25 or so printers (compared to just two in 1979).

But price is not the only variable. One must consider print quality, print type, paper type, speed, noise, controls, graphics capability, interfacing, servicing and longevity.

Unfortunately, this last characteristic, longevity, is extremely important, but nearly impossible to measure when a printer is new or nearly new. Moreover, a sample of one or two is not sufficiently large to derive frequency of repair or length of service figures. Therefore, one must make some informed judgments in the area of longevity based on manufacturer history and reputation, design of the unit, number of moving parts, and the like.

The large number of printers available and the many more being introduced every month make it nearly impossible to review all of them or even a majority in one issue, or even 12 issues. Hence, we chose to review a cross-section of printers, several with new design features, in this issue. As we have in the past, we will continue to review printers throughout the year, sometimes singly and sometimes in a group.

To select a printer, you should familiarize yourself with printer types, capabilities, and features. Then when you see a printer in a store or advertisement you will be able to make an intelligent evaluation of it, both compared with others in the field, and, more important in terms of meeting your needs and budget.

Here we present a discussion of various features that will help you to evaluate printers.

Type of Print

Basically, type of print falls in one of two groups: dot matrix or fully formed characters.

A dot matrix printer uses a vertical row of wires which strike the ribbon as the printhead travels across the page. The printhead usually has either seven or nine wires. A character is formed from a matrix of dots, usually 5 x 7 (5 dots wide and seven high) or 7 x 9. Increasingly, manufacturers are using other arrangements to produce a more attractive character set. One novel approach uses seven wires which are slightly staggered.

Although dot matrix printers today are a considerable improvement over those of just two or three years ago, they still fall a bit short of what most people consider "letter quality." Even the best dot matrix printers cannot produce a character as precise in detail as a good

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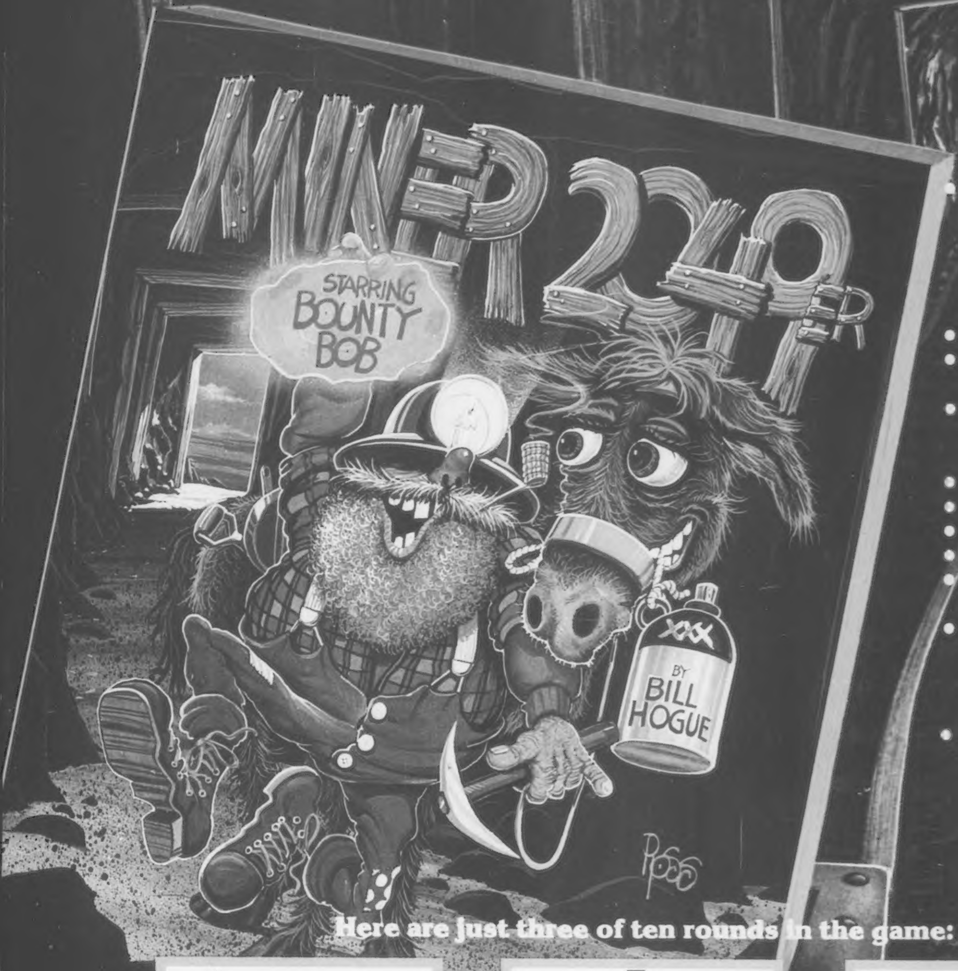

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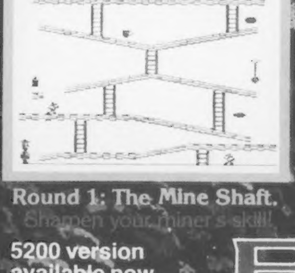
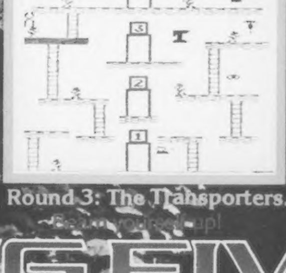
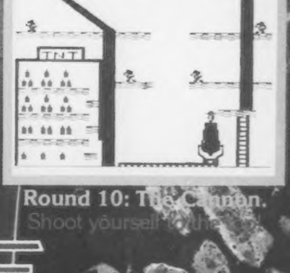


Round 1: The Mine Shaft.
Sharpen your miner's skill!



Round 3: The Transporters.
Beam yourself up!



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by Tom Snyder
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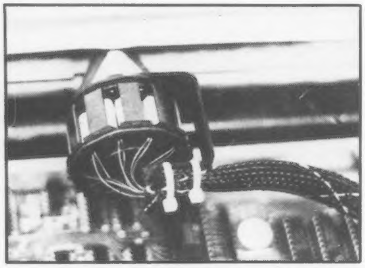
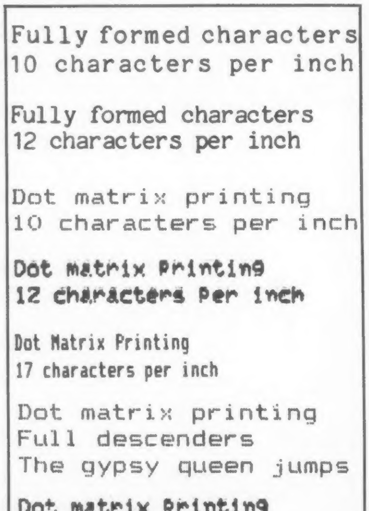
typewriter can produce. On the other hand, many dot matrix printers produce print good enough for routine correspondence, memos, internal products, program listings, financial printouts and the like.

A printer with fully formed characters is sometimes called "letter quality," meaning that it is suitable for most formal business correspondence. Essentially, it is equivalent to an electric typewriter.


Dot matrix print element has a pair of wires leading to each of seven solenoids corresponding to seven striker pins.

However, just because a printer uses fully formed characters does not automatically mean that it is better (or even that it produces a better-looking document) than a good dot matrix printer. Just as electric typewriters run the gamut from cheap home portables to top quality office units, so do printers, but even more so.

Print samples.


Fully formed characters
10 characters per inch

Fully formed characters
12 characters per inch

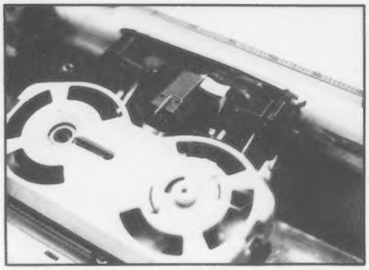
Dot matrix printing
10 characters per inch

Dot matrix Printing
12 characters Per inch

Dot Matrix Printing
17 characters per inch

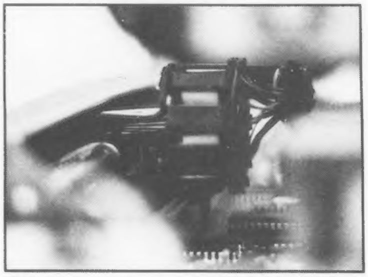
Dot matrix printing
Full descenders
The gypsy queen jumps

Dot matrix Printing
No decenders
The gypsy queen jumps


Daisy wheel print mechanism with ribbon cartridge in place.

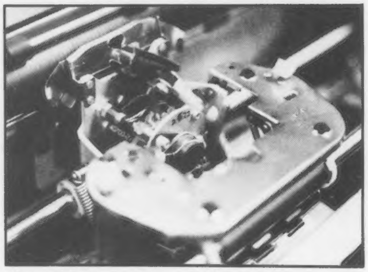
This wide range of quality is due mainly to the print mechanism. These are of four types. First is the mechanism found on manual and older electric typewriters in which each letter is on the end of a typebar. This is a cumbersome mechanism and, because of carriage movement at the end of each line, is not suitable for continuous forms. Few, if any new printers are being produced using this mechanism—and with good reason!

Second is the typeball mechanism pioneered by IBM on the Selectric typewriter. Some typeball printers are simply office electric typewriters with solenoids installed to pull down the keys. These are not designed for continuous duty even though outwardly they look virtually identical to IBM units built for use as terminals. Although a few new typeball printers are being built today, most are either modified IBM office electrics or reconditioned (i.e., used) IBM terminal units.


Side view of dot matrix print head shows pins.

A third, and perhaps the most popular, mechanism is the daisy wheel—so called because it looks like a black plastic (or metal) daisy. (Actually, it looks more like a chrysanthemum, though I can well understand why it was not called a chrysanthemum wheel.) This little 4" diameter wheel with molded characters on the end of each spike constantly spins, and a solenoid strikes the correct character when it is at the 12 o'clock position. The wheels come in plastic and metal. The metal ones have a longer life (and cost more).

A variation on the daisy wheel is the thimble design. A type thimble looks like a daisy wheel that has had its petals bent down over a small Dixie cup. (I'd hate to meet the person with a finger big enough to use one of these babies as a thimble.) The striker mechanism is similar to that in a daisy wheel printer.


An older design of daisy wheel print mechanism.

Print Quality and Style

As suggested above, the print quality of a dot matrix printer is not as good as that of a fully formed character printer, but it is quite adequate for many purposes. Since not all manfacturers use the same dots within the matrix to form the same character, personal preferences come into play. Look especially at the following letters on different dot matrix printers to see which you prefer:

W,a,f,g,j,k,p,q,r,w,f,4,5,*,@,$,&

Perhaps the most important element of print quality, if you are considering using your printer for outside correspondence, is lower case descenders. Many people find the absence of descenders objectionable, and a document produced without them is noticeably more difficult to read than one with descenders. However, if price is your most important consideration and you use mostly words without g, j, p, q, and y . . .

In addition to printing the original, printers are often called upon to make carbon copies. Like typewriters, some do this considerably better than others. In general, on fully formed character printers, a metal daisy wheel, thimble, or typeball will produce better carbons than a plastic one. Dot matrix printers do not count among their strong points the ability to produce good quality or large numbers of carbon copies.

You may also wish to look at print samples on different types of paper. For example, rag bond watermarked paper has more texture than "normal" computer paper; this affects the amount of ink transferred to the paper, sometimes causing the type to look uneven. If much of your work will be on paper of this type, be sure to try it out.

On individual characters, you might

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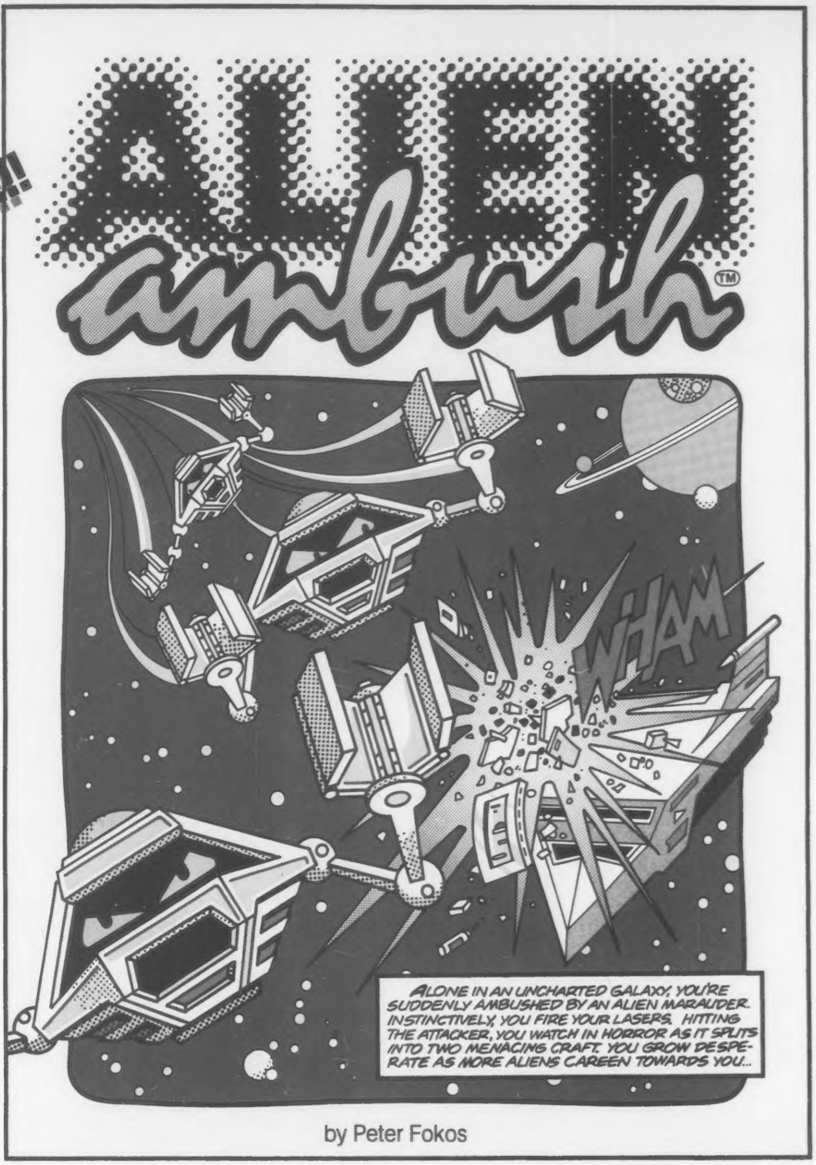
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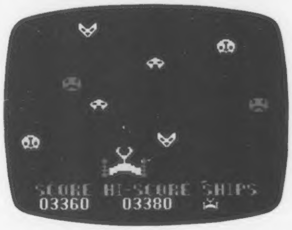
by Peter Fokos

You haven't lived until you've died in space.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And here's your chance.

Software author Peter Fokos has created Alien Ambush, a space age nightmare. It's a hi-res, full-color arcade game, fiendishly written to give those nasty aliens every advantage.

So if you have access to a 48K Apple* with DOS 3.3 or a 16K Atari 400/800** with a disk drive, and you're hot for some new thrills, Alien Ambush was written for you. But be warned: it just got a lot tougher to survive in space.

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CIRCLE 219 ON READER SERVICE CARD

Glossary

Bi-directional: the ability to print with the printhead moving right to left, as well as left to right. Eliminates need to reposition printhead to left margin for every line.

Buffer: the area in which excess data are stored until the printer is ready to print them. This area is described by amount of memory (less than 1K is very small, with 2K about average).

Characters per second, or *cps*: the number of characters that a printer is capable of printing in one second.

Character set: the style of type output by the printer, also known as the type *font*.

Descender: the portion of a letter that trails below a line. The lower case letters g, j, p, q, and y and sometimes the upper case Q have descenders. The fonts on inexpensive printers often lack true descenders.

Dot matrix: a method of printing wherein each character is composed of an array of dots, as opposed to *fully formed characters*.

Electrostatic print: when characters are etched onto paper using a small electrical charge.

Friction feed: when the paper is advanced and held in place by friction between two rollers. This allows for the use of single cut sheets of paper.

Fully formed characters: when the character is formed all at once, upon impact of a striker, through a ribbon, onto the paper. This category includes daisy wheel, typeball, and thimble printers.

Graphics: the ability to print specific graphics characters in addition to text. An increasingly necessary printer feature.

Hard copy: a printout.

Horizontal tabulation: the ability to let the user specify, through hardware or software, the number of columns per line.

Impact print: when print is obtained by the impact of a striker through a ribbon. This category includes fully formed character printers as well as many dot matrix printers.

Ink jet: a new technology wherein a printhead blows small streams of ink onto the paper to form the characters.

Laser printing: a state-of-the-art technology which uses a laser to burn print onto the page.

Letter quality: an abused term which once simply meant print quality indistinguishable from correspondence prepared by traditional (typewritten) methods. Once no dot matrix printing was considered to be letter quality; new technology and recent advertising have worked to change this. Undoubtedly the quality of letter quality is in the eye of the beholder.

Line spacing: the number of lines per inch.

Logic-seeking: the ability of a printhead to discern the quickest route to its next printing position.

Multipass: the ability for a printhead to be controlled, through hardware or software, to remain on the same horizontal line, and print on top of existing copy.

Noise: quite simply, the sound a printer makes. This varies greatly from printer to printer, and may be significant not only when a printer is printing, but when it is waiting to print.

Out-of-paper warning: a small but convenient feature of some printers to signal that the paper supply is out.

Parallel interface: a method of sending printing codes from a computer to a printer or other device, wherein typically one entire byte of information is sent simultaneously. A majority of microcomputer printers use this approach.

Pin-feed: a method of paper transport in which paper is pulled through the printer by a sprocket with pins, fitting perforations punched in the paper. Same as *sprocket feed*.

Plain paper: usually refers to regular cut sheet bond, as opposed to roll, fanfold, or treated electrostatic and thermal papers.

Print density: the size of the matrix used for each character. The more dots per character, the better the character will look.

Printhead: the device which houses the printing mechanism. As opposed to portable and older office typewriters, the paper moves only vertically, while the printhead usually moves from side to side.

Print quality: refers to how the characters actually look on paper.

Proportional spacing: refers to the spacing of individual characters. The font you are reading now is proportional: an *i* is narrower than an *m*. Printers with proportional spacing capability can create more professional output. Most daisy wheel printers, like most typewriters, do not offer this feature.

Self-test: many printers have this built-in test feature which simply spurts out the entire character set.

Serial interface: a method of sending printing codes from a computer to a printer or other device, wherein one bit of information is transferred at a time. This is usually slower than parallel interfacing, and commonly makes use of an RS-232 port.

Thermal print: requires special heat-sensitive paper that darkens when a hot printhead "burns-in" the dot matrix. Similar to, though quieter than, electrostatic printing.

Tractor feed: very much like pin or sprocket feed, with pins revolving on a tractor tread.

True descenders: see *descenders*.

Vertical tabulation: allows the user to specify the number of lines to be printed on a page of paper. *—OWL*

want to examine ink density, edge definition, and "fuzziness" with a low-power magnifying glass. Also, look at density at both the top and bottom of the page. Print the same line or short paragraph for a page or two; the last lines should look the same as the first.

On fully formed character printers, look at a dense letter such as a capital M next to a small character such as a period or comma. A good quality printer will automatically adjust the striking force so the ink density is the same on both characters. Beware if the M looks light compared to other letters and the periods and commas make the back of the sheet feel like Braille.

A popular misconception is that all characters should be in a perfect line. This is not true. In most character sets, round letters such as c, e, and o are slightly larger than "square" letters such as r, n, and u. The lower case t is not as high as h or l. A good fully formed character printer preserves these nuances, which contribute to a pleasing visual impression. Since the dots in a dot matrix printer are always in exact alignment, the print lines will be evenly-printed, uniform, and somewhat boring.

Print Speed

If you are buying a printer for a company or if you are a very prolific author with a print requirement of a million sheets per month, a very high speed printer (900 lines per minute or more) will be needed. In general we are not considering these units here, and for buying advice we recommend you turn to *Datamation* or another DP managers' magazine.

A high speed printer with a print speed in the 300 line per minute neighborhood is suitable for volumes of 50,000 sheets per month.

For people who require fewer than 50,000 sheets per month, slower printers are quite satisfactory.

Some manufacturers publish print speeds in lines per minute and others in

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characters per second. There is good reason for this since some printers print an entire line at a time, and, whether the line consists of one character or 120, it takes the same amount of time to print it.

On the other hand printers which print a character at a time can rush over a single character line and get on to the next one lickity quick. So, it is difficult to compare the true speed of a line printer with a character printer. In general normal business correspondence and reports have 60 characters per line. A little arithmetic leads to the "rule" that, for a 60-character line, lines per minute equals characters per second.

But what does this mean? Well, a typist working at 60 words per minute is typing about 6 cps. A double-spaced page contains about 250 words. Thus a 60 wpm typist could type such a page in a bit over four minutes. A 100 cps or 100 lpm printer ought to be able to produce the same page about 17 times as fast as our typist, or in about 15 seconds.

Oh, that it were so simple. But at least it is a good starting point. Complicating things is the fact that the published manufacturer speed rating is usually considerably faster than what a printer produces in actual service. This is due to linefeeds, carriage returns, computer "handshaking," and perhaps even some just plain exaggerated claims. Nevertheless, since all manufacturer figures tend to be high by roughly a factor of two compared to actual service speed, they provide at least a comparative measure of speed.

As with cars, package delivery services and running shoes, higher speeds cost more money. However, it is probably worthwhile to look for a printer that is somewhat faster than you need today. There are two reasons for this. First, inevitably, your print requirements will increase. Yes, you read about an all-electronic, paperless society, but somehow it always seems to be in the future.

The second reason to look for a faster printer than you "need" is that most printers are not built for continous duty. A 100% duty-cycle means operating hour after hour producing pages filled solidly with letters and numbers. Printers that are run beyond their duty-cycle capabilities will suffer greatly increased malfunctions and breakdowns. While many (all?) manufacturers claim "long life" for their machines, duty-cycle ratings are often not clearly stated. Ask about them.

Bi-directional Printing and Print Buffers

Some printers are designed to print from right to left as well as from left to right. This saves time in that the printhead does not have to return to the left side of the page at the end of each line. While it sounds like a neat capability, the real time saving is fairly small. A typical printhead return is accomplished in about the time it takes to print three characters, so if you are printing lines of 75 characters, the time saving is about four percent.

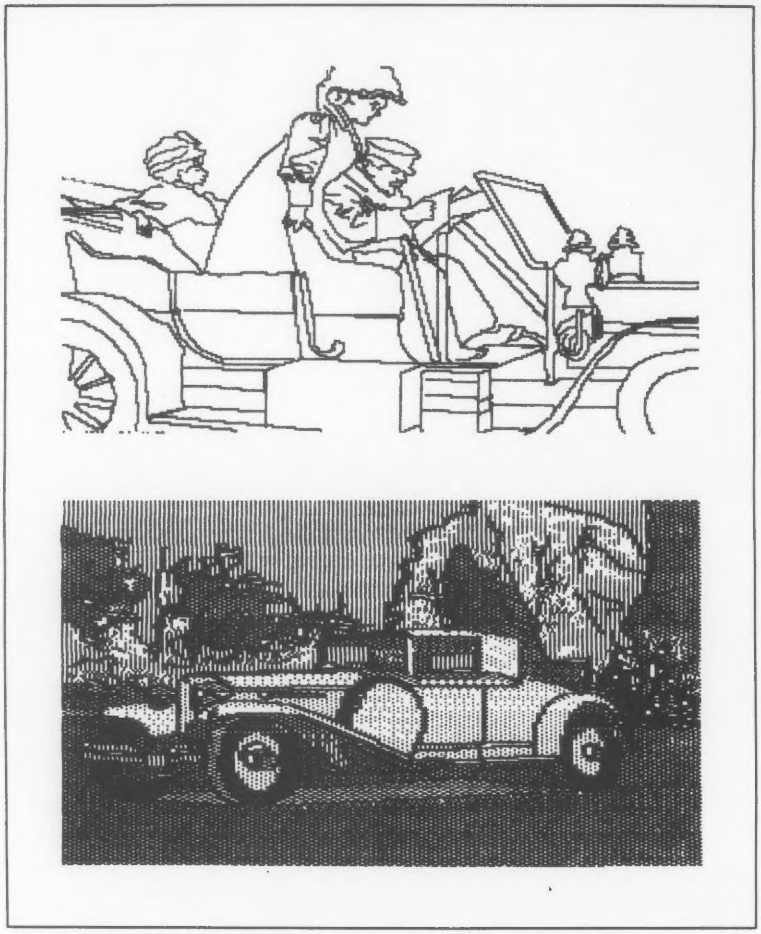
In order to print in both directions, a printer must have a buffer to store temporarily the line that is to be printed "backwards." In some printers, this is useful beyond permitting bi-directional print capability, as the buffer is able to accept data from the computer at a high speed and with less "handshaking" than is required without such a buffer. In general, this leads to more accurate transmittal of data. It also lets the printer proceed steadily at its own speed, when the information coming from the computer arrives faster or slower than the pace of printing.

The size of the buffer indicates whether it will store just one line for bi-directional printing (buffer size = length size, say 100 or 150 characters) or if it will store a page or so. A 2000 character storage capability (about 1-1/3 double-spaced pages) is common.

Characters, Lines, and Spacing

Different printer uses require different character sets (letters, numerals, symbols). Most printers provide character sets (or fonts) that include both upper and lowercase letters, the number 0 to 9, and a set of symbols. Frequently the print symbols will not match those on your computer keyboard. For example, an up arrow on the keyboard may print as a left bracket, and so on.

Be sure that the character set on the printers you are considering will meet your needs. While print wheels can be changed to provide a different character set, you do not want to have to do this in the middle of a document.



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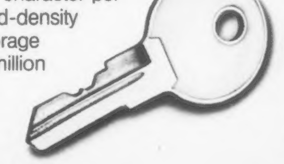

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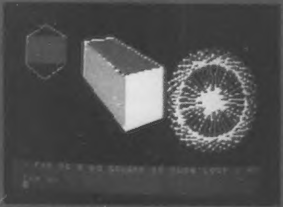

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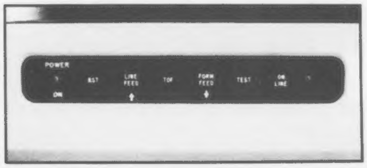
CIRCLE 281 ON READER SERVICE CARD

Dot matrix printers, because of the way they produce characters, can theoretically produce any character at all. However, certain characters are "built-in;" these comprise the character set.

Some dot matrix printers have an option which permits making characters double size, bold, italic, compressed, or otherwise enhanced. This can be done during printing by having the computer send the printer the appropriate non-printing character. For example, an ASCII 14 turns on double width mode on the Epson MX80. This sounds like a wonderful capability (and it is!) but unfortunately some word processing software packages are unable to generate or process the required control characters. Hence, you should be sure that the printer you are considering is compatible with the word processing package and other software you are using or plan to buy.

Pitch is the number of characters printed per horizontal inch (cpi) in the "normal" or default mode. In general this will be 10 or 12. A higher cpi, say 13.2 as found on the Teletype 43, results in more words fitting on a page but may also result in lower readability.

Many printers offer the option of selecting different cpi spacings. In some cases, cpi can be changed while printing by means of a control character (which your word processing software may or may not be able to send). In other cases, cpi can be changed with a switch on the outside of the printer. On other printers, this switch is inside and accessible by raising the cover or front panel. The least satisfactory arrangement is a DIP switch in the guts of the printer accessible only by removal of the bottom plate or back panel. But before worrying about the convenience of changing cpi, ask yourself if you really need to do it at all.



Typical printer controls on the outside of the housing include reset, line feed, form feed, on/off line and, sometimes, test.

Printers are also rated in lines per inch (lpi) which is the number of lines printed per vertical inch. Standard typewriters print six lines per inch; both six and eight lpi are commonly found on computer printers. As with cpi, many printers permit spacings other than the standard.

Paper Size, Feed and Movement

For various purposes, printers may be required to handle paper of different widths, continous forms, multi-copy paper, envelopes, labels, etc. Figure out what you need before you go on your printer quest.

Fast becoming the standard for personal computers is continous feed paper measuring 9-1/2" x 11". When the strips on each side with the sprocket holes are torn off, the resulting sheet is a standard 8-1/2" x 11".

However, some printers accept only paper that is 8-1/2" wide. Continous feed paper measuring 8-1/2" x 11" does not have perforations that allow the sprocket holes to be removed; this is unsatisfactory for all but the most informal of applications.

There are two types of feed mechanism, friction and tractor. Although sprocket feed and tractor feed are not the same, the differences are not worth worrying about. As the name implies, with friction feed the paper is moved through the printer by friction against the carriage and pressure rolls in much the same way as in an electric typewriter. This can result in an uneven feed, particularly when continuous form paper must be pulled from a box on the floor. Thus manufacturers of many friction feed printers offer an optional tractor feed mechanism for use with continous forms.

For tickets and multiple part forms, a specialized printer may be required.

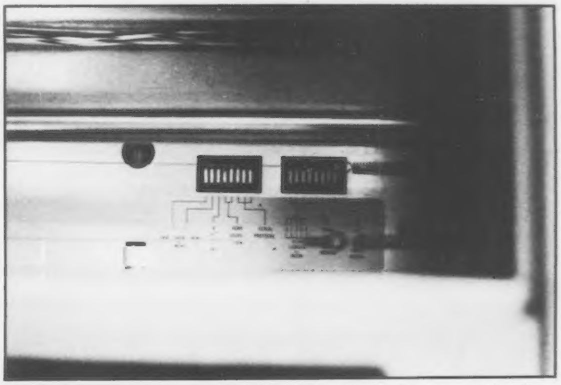
Another optional feed device available for some printers is an automatic single sheet handler. This allows several hundred sheets of paper or letterhead to be stacked and then fed automatically, one at a time, into the printer.

Envelope handlers operate in much the same way as single sheet handlers, feeding envelopes, one at a time, from a stack.

It is more difficult to use letterhead or envelopes in a tractor or sprocket feed printer. One approach is to attach individual sheets of stationery to sprocket feed computer paper and then load it

PAPER OUT
SPEED
PARITY
PITCH
TEST
ERROR
PAPER
ATTN
RIBBON
MODE
DATA
LOCAL
PROCD
POWER
OFF
7
8
9
4
5
6
P

Additional controls on many printers are found below the top or front panel.



Sometimes switches are hidden beneath the bottom or back panels. You can hope these are rarely needed.

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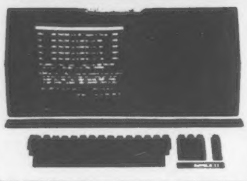

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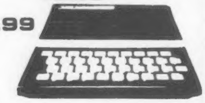

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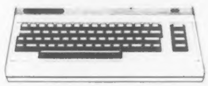

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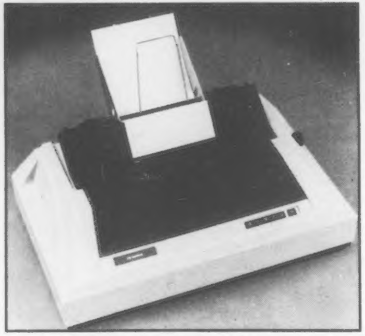


A single sheet feeder can be attached to some tractor and pin feed printers.

into the printer. Peel-off envelopes, which can be attached to continous feed paper, are also available. This approach is anything but convenient and has driven more than one user to buy two printers.

A small handful of printers allow printing subscripts and superscripts. To do so involves vertical movement of less than a full line and then a return to the main print line. This requires control characters from the computer on both sides of the sub- or superscript. This capability is rarely worth the effort and expense.

Noise Control

Printers are rather noisy creatures since in most a piece of type or a group of pins are striking a piece of paper with a roller behind it. Those with typeballs or metal daisy wheels are especially noisy.

There is no common industry measurement of printer noise (like decibels three feet in front of the printer), so most manufacturers simply claim their printers are "quiet." Some manufacturers have gone to great effort to keep their printers as quiet as possible by lining the case with layers of acoustic foam while others have achieved quietness by virtue of clever printhead design. Still others have ignored the problem entirely.

We recommend listening to various printers in a store before buying one. But bear in mind that it will always sound noisier in your office or home (one of Murphy's unstated laws).

Interface

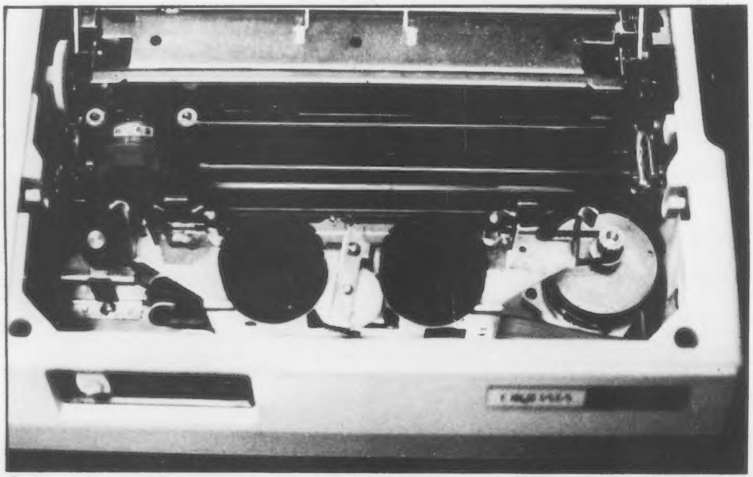
Most printers have either a parallel or serial interface, and many have both. This does not mean that you can necessarily plug a Brand X printer into a Brand A computer just because they both have a parallel interface. Would that it were so simple!

Two parallel interface standards are in common use, one established by Centronics and the other by Dataproducts. But many computer and printer manufacturers think they have a better way and do not adhere to either of these standards.

Serial interfaces also come in two basic flavors, the old 20 ma current loop interface started by Teletype Corp. and the RS-232C interface.

The IEEE also has an interface standard which is beginning to be offered by some manufacturers; other groups also have proposed standards. However, at the moment there is virtually no industry-wide agreement.

Further complicating the situation is the interface cable. On various computers you will find a huge variety of connectors—dual 17-pin flat, 5-pin DIN, 40-pin connector, A-800, C-130, and on and on. There is less variety on printers, but the point is that you will need a cable to go between your printer and your computer, and it doesn't generally come with either unit. Unless you are quite comfortable reading schematic diagrams and soldering tiny pins, we do not recommend making your own cable, even though you may save more than half of the typical $25 to $50 cost of a cable.



Some printer ribbons are in easy-to-change cartridges. Others use typewriter-like spools that are more difficult to change.

Service and Maintenance

There are no perfect printers. All of them require service and maintenance sooner or later. However, a well-designed printer is easy to maintain and should require only infrequent service. Nevertheless, it is important to realize that occasionally it will be out of service. Unlike an office typewriter for which there can usually be found a spare around, it is unlikely you will have a spare printer in reserve.

When the ribbon or paper runs out, or when the paper feeds incorrectly or jams, a well-designed printer will stop by itself and alert the operator with some sort of audible alarm, visual indicator, or both. Lightweight paper is more likely to jam due to enlargement and tearing of the sprocket holes. If you intend to use a lightweight 15# paper, be sure to try it in the printers you are considering.

A printer should be cleaned and vacuumed out periodically depending upon its frequency of use. Paper dust is an enemy of the precision gears in the printhead and paper movement mechanisms and can even hamper the operation of the solenoids in the printhead. A $24.95 hand vacuum is well worth the investment if it saves just one service call.

When you purchase your printer, it is probably worth getting two or three extra ribbons at the same time. Although ribbons dry out if they are left too long on the shelf, they come in sealed plastic packages which should keep them fresh for at least six months. Nothing is more maddening than trying to print a finished business document to send to somebody important and suddenly realizing that your ribbon can produce only a light shade of gray. (We receive scores of articles from prospective authors printed in light gray. Frankly, they don't get as careful a reading as those printed with a good, black ribbon. Perhaps we unconsciously feel that the care taken in appearance reflects the care taken in writing.)

As might be expected, all manufacturers claim that their printers are highly reliable. Unfortunately, there is no industry standard for measuring mean time between failure, percentage of up time per thousand hours, etc. Thus, manufacturer reputation comes into

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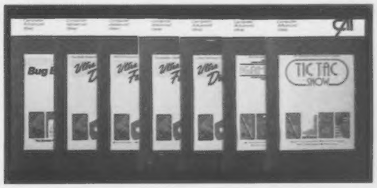

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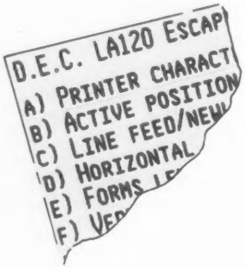
"Flexibility" means instantaneous call up of any of this trend-setting machine's many features whether for *word processing, data processing, graphics* or *forms generation*. Using either of the two built in interfaces, an external keyboard or downloading from your computer, you can program the Qantex Model 7030 to do more.

The"Beautiful"Font



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B) ACTIVE POSITION
C) LINE FEED/NEW
D) HORIZONTAL
E) FORMS
F) VE

Compare the "Beauty" of our printed letters for the word processing fonts which include Cubic, Trend, Spokesman, Courier, Italics, Script, OCR-A, APL, Scientific plus *downloaded* fonts from your computer. Draft copy modes include 8 resident fonts — U.S., U.K., German, French, Spanish, Swedish, Finnish, Norwegian and Danish.

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60 Plant Avenue, Hauppauge, NY 11788
(516) 582-6060 (800) 645-5292

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*Registered Trademark of North Atlantic Industries play, but even that is a less than perfect guide since new manufacturers have no reputation, good or bad, to go by and established manufacturers may introduce a new design significantly better or worse than past ones.

We recommend gathering as much information as possible about reliability and service from stores, friends, clubs, magazine reviews, and manufacturer literature before plunking down your money for a printer. On a new printer today, it is reasonable to expect that outside service should be necessary no more than twice a year—assuming, of course, that the printer is suitable for your volume of work.

However, you will inevitably need some outside service sooner or later. Find out in advance where the printer must go, or whether someone is available to come to your premises. Some manufacturers provide service at regional depots, others depend upon the local dealer, while still others recommend a "third party" maintenance organization such as Sorbus or RCA.

Color Printers

During the past two years, six dot-matrix printers have been introduced capable of printing multiple colors. These use a variety of different printing techniques. One has a ribbon with the first quarter impregnated with red ink, the second quarter with yellow, the third with blue and the last with black. A page is printed with the first color, then the feed is reversed and the sheet brought back to the top and printed with the second color and so on. Another approach uses a wide ribbon with four colors on it in horizontal stripes; a ribbon positioning mechanism is used to place different colors under the printhead.

Color ribbons are generally available in both black plus the three primary colors (red, yellow, blue) and black plus the three primary printing colors (magenta, yellow, cyan). The first is best for pure, solid colors (graphs and charts), while the second is better for color mixing to produce full-color effects (pictures).

No color printer will produce an image as good as a photograph or printed picture. However, they are excellent for producing business charts and rudimentary graphics.

Non-Impact Printers

All the printers discussed thus far have been impact printers of one sort or other. There are, however, many printers that produce output without using any kind of mechanical impact, relying instead on a variety of clever, non-impact techniques.

Few of these printers have received wide acceptance, but each has its followers and devotees.

Thermal and electro-sensitive printers share many characteristics. Both types use sensitized paper usually on a roll rather than single sheets or fanfold. Both can produce only one copy at a time. They are very quiet and relatively inexpensive.

Thermal printers use heat sensitive paper which is activated by heat wires or pins that press against the paper to form characters. These printers are generally relatively slow (30 to 120 cps). But for a basic utility printer in applications where roll paper and modest print quality are acceptable, a thermal printer may fill the bill.

In a similar manner, electro-sensitive printers use a paper with a special metallic coating. These are faster than thermal printers (speeds up to 225 cps), and produce a slightly better quality copy although other metallic objects (coins, letter opener, pencil, clip, etc.) will leave marks on the sensitized paper.

The price of ink jet printers has been plummeting recently, putting some of them within reach of personal computer users. These machines literally squirt characters onto paper from specially designed ink nozzles. The speed and price range is extremely wide—speeds from 30 cps to 3000 lpm (yes, lines per minute!) and prices from around $2000 to over $30,000. Characters are generally produced in the form of a dot matrix, although ink jet printers tend to use more "dots" and thus produce a slightly better result than a standard dot-matrix printer.

There is at least one ink jet color printer on the market. It produces a somewhat more satisfactory image than the output from dot matrix impact printers.

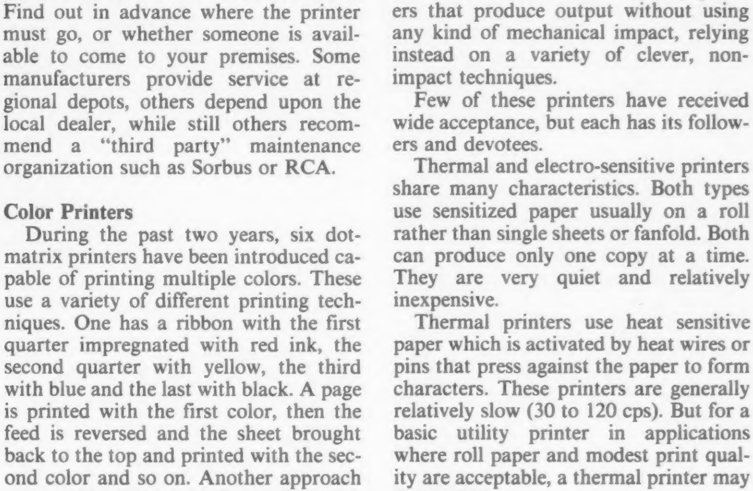
There are three other technologies used in high end printers: lasers, electrostatic toner (like a Xerox copier), and magnetic image transfer. Printers using these technologies generally sell for $10,000 and up (far up—one laser printer goes for $300,000) and are aimed at specialized, high-volume operations.

In Summary

When selecting a printer, the first thing to do is analyze your needs. What quality do you need—draft, correspondence, or letter? What volume do you expect to print, i.e., how fast a printer do you need? Do you need extra character sets such as Greek letters, mathematical symbols, italics, or extended letters? Do you expect to output graphics? What kind, graphs or "pictures"? Will your printer have to handle single sheets, continuous feed paper, forms, envelopes, labels or wide paper? Will it be located in a relatively quiet place where you and others are working? What kind of computer and software do you expect to use with it? How much time can you afford?

When you have answered the above questions, you should start gathering as much information as you can from as many sources as possible—friends, clubs, magazine reviews, advertisements, trade shows, stores. Try to narrow your choice to two or three acceptable printers. Then determine for each an acceptable maintenance arrangement; this is generally more important than the purchase price.

Remember, in purchasing a printer, the true cost includes not only the purchase price, but supplies, technical support, routine maintenance, repairs, and down time. ☐



Ink jet print element has seven tubes leading from the ink reservoir to the jets.

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evaluation

Print About Printers

John J. Anderson

So you want to buy a printer, eh? Well you are not alone in that. Nor are you alone in your probable confusion concerning which printer to buy. Printers are the fastest-growing peripheral market in the microcomputer industry today. It seems as if a new crop of them appears every six months or so. Print quality and extra features continue to improve, while prices continue to fall. That is, on the whole, quite good news, but it makes the job of deciding on a printer really tough. "If I just hold out," you may be saying to yourself, "I'll be able to get more for less." And though salespeople may deny it, you'll be right. But you'll be hurting if you hold out too long, for every day you hold out is another day without a printer. Read on, and decide how long you can wait.

Just two years ago, a serviceable dot matrix printer cost about $1000 and needed service on an average of twice a year. Then the $500 Epson MX-80 made its debut and changed everybody's expectations. It was quiet, affordable, reliable, easy to use, and produced nice copy. It remains one of the most popular microcomputer printers.

As Dave stated in the preceding article, the most important consideration a buyer can make about a printer is one any reviewer has a justifiably hard time evaluating: reliability. Until at least a few months have passed, it is nearly impossible to make a fair judgment regarding the reliability of a printer. As opposed to a computer, which seldom has any moving parts aside from its keyboard, a printer is a mechanical contrivance, and therefore heir to all the potential problems mechanical devices can suffer. It is fair to expect that a printer will receive at least annual service, even if it is running just fine. In that way the owner may ensure that it will continue to do so.

There are certain judgments that can be made upon first inspection of a printer—and, in selecting the right machine, you must choose the right criteria on which to base your decision. Here we look at 13 machines, judge them in terms of several criteria, and draw overall conclusions concerning what a consumer can expect from a printer within a selected price range.

To get a firm idea of what one should judge in a printer, let's first examine the criteria themselves.

Type: By this we mean the method of printing the machine uses. Categories here are daisy wheel, dot matrix, and ink jet. Your decision here will depend on what quality of print you need, and at what speed you want to produce it. We will pass no judgment on this criteria, though we will consider no thermal or electrostatic printers. The price of impact dot matrix printers has dropped to a point where thermal and electrostatic printers, which require specially treated papers and are typically lacking in print quality, now have a markedly decreased appeal.

Feed: This indicates the means by which the paper is propelled through the printer. If you are interested in using bond or letterhead paper, you will require a friction-feed machine, which handles paper the way a typewriter does. Tractor-pin-, and sprocket-feed machines will, in contrast, allow the use of continuous form paper, in roll or fan-fold format. Obviously a continuous format will be more convenient for high volume printing, unless you are prepared to pay for a machine that offers automatic single sheet feed. This option is generally only available on machines costing over $2000.

Speed: An underscored caveat should be posted here. Just as the EPA ratings for automobile mileage in no way reflect actual road conditions, the speeds claimed for printheads in no way reflect actual print conditions. For comparison, however, the numbers can be helpful in determining the actual "throughput," or true speed at which work is turned out by the machine. Fully formed character printers such as daisy wheel printers are the slowest, typically having speeds of less than 30 characters per second (cps). Dot matrix printers can produce rates up to 200 cps, with print quality decreasing inversely. The ink jet printer we tested has been rated at 270 cps, which is quite fast.

Interface: This criterion takes into consideration how easy (or difficult) it is to hook the machine up for use. Since nothing remotely resembling an industry standard has yet been adopted, getting a printer up and running can sometimes be a dramatic challenge. The closest thing to a standard currently available is the famed "Centronics-compatible" connector for parallel connection (curiously, no longer used by Centronics printers), and the time-honored DB-25 connector for serial connection. These are the connectors I am happiest to see when I look at the hind side of a printer. I am quite frequently disappointed, however. One can only pray that some time soon a standard will be agreed upon.

Density: This refers to dot matrix and ink jet printers only, and specifies the maximum number of dots that can be printed horizontally and vertically. The more dots that are available in a dot matrix, the better the quality of the print. Specifications are sometimes given by the

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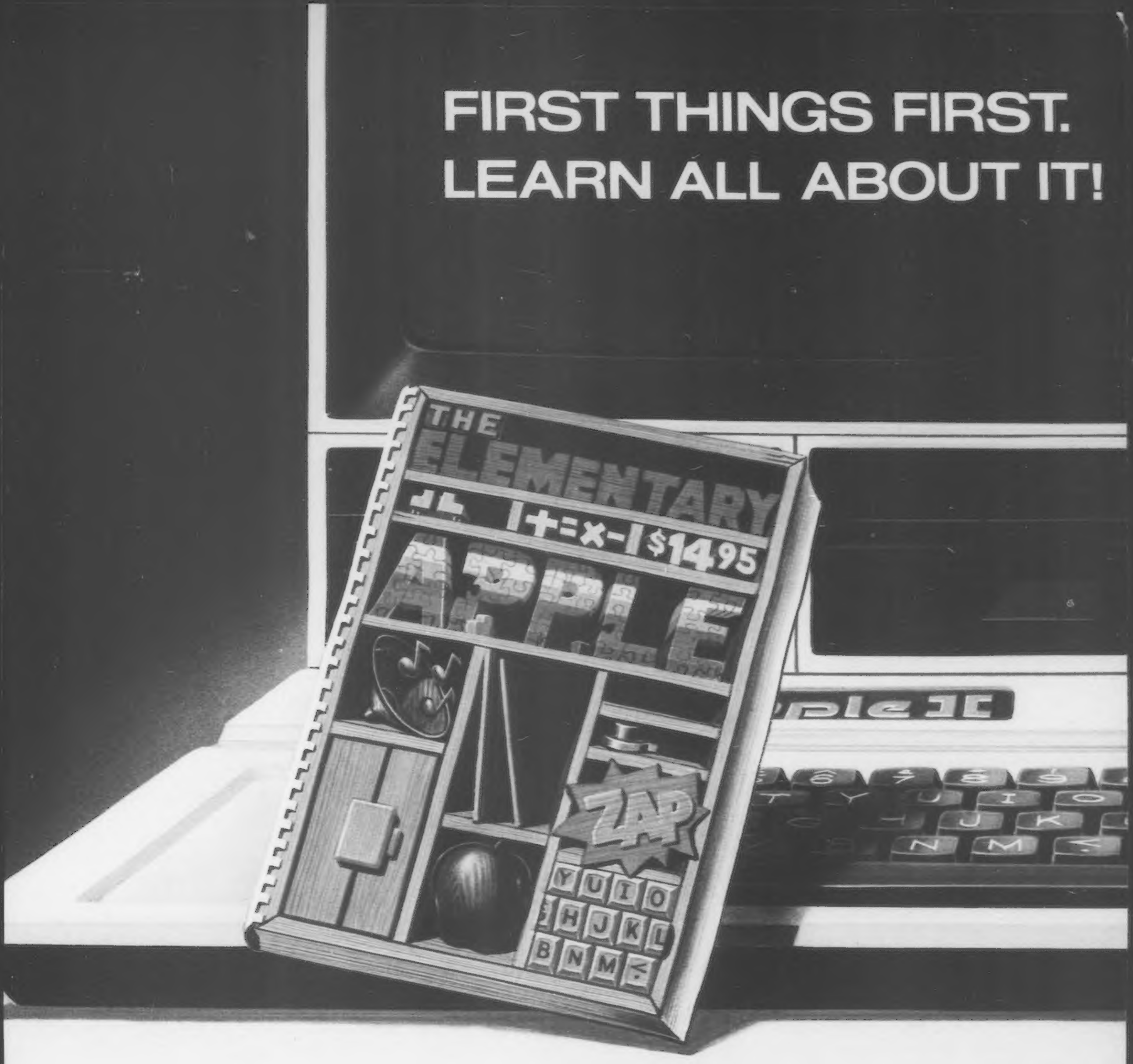

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character, sometimes by the inch. A minimum matrix is composed of 5 x 7 dots.

Graphics.: Again, a consideration only for dot matrix and ink jet printers. Generally a yes or no question, it indicates whether dots in a matrix can be addressed individually to create graphics displays. Think carefully before you dispense with this capability—the time will probably come when you will miss it. For example, without graphics capability you will have trouble listing programs that include control characters.

Character sets: Again, a feature pertinent only to dot matrix and ink jet printers. Specifies the number of built-in fonts the printer can generate. Typically fonts are distinguished by their varying *pitches*, meaning their widths, which are measured in characters per inch, or *cpi*.

Buffer: The amount of text which can be stored in printer circuitry prior to actual printing. Some printers offer buffers up to 48K, so that an entire document can be dumped to the buffer, freeing the microcomputer to go on to other tasks while the printing takes place.

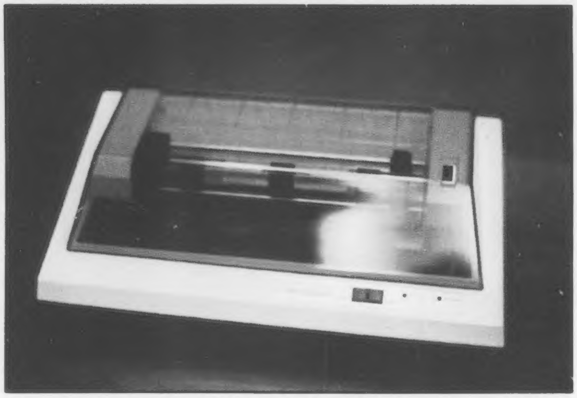
Logic-seeking: The ability of a printer to exercise some flexibility in advancing to the next printing position. Rather than an unwavering carriage return and linefeed at every end of line, a logic-seeking printer will determine which way is fastest, and then take that way. *Bidirectional* printing means the printhead can print from right to left as well as left to right. This does not always ensure a faster route, however, as in the example of a list of numbers running down the left-hand margin. A "smart" bidirectional printer would not make a mistake in this case, but rather print unidirectionally from the left-hand margin.

Noise: Another warning is in order here. For purposes of comparison, we used a noise level meter to measure the noise in decibels, during printing, one meter from each printer. We placed each printer on a noise-deadening mat of foam, as we assume the noise-conscious consumer would do. The numbers presented here indicate the results. They are best used for purposes of comparison only.

Price: This in all cases indicates the list price of the unit. Quite frequently the printer can be purchased for substantially less than the manufacturer's list price, however.

Overall rating: We have given each printer a rating of 0-4 stars, based on the ratio of its performance to its price. This approach has its faults, but it accurately reflects our opinion about the hardware. A rating of one star is fair-poor, two stars fair-good, three stars good-very good, and four stars very good-excellent.

With these explanations in mind, let's take a close look at some printers. Hold on to your fonts, folks.



The Seikosha GP-250X: trade-offs for a price.

Seikosha GP-250X

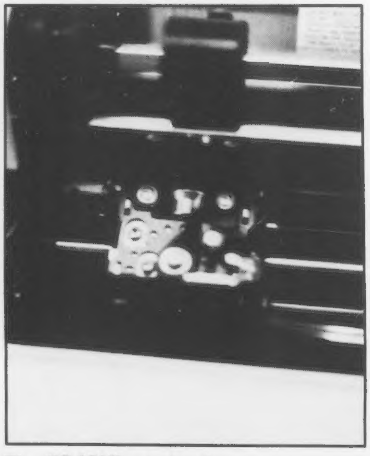
Full Features at a Discount Price

The Seikosha GP250X is an example of the new under-$500 generation of printers. It offers a tolerable dot matrix print quality with built-in graphics capability, and the capacity for paper widths up to 10 inches.

With a claimed speed of 50 cps, the GP-250X is not a speed demon, but it does offer a bi-directional, logic-seeking printhead. We dare say that speed will not be a major consideration for buyers of this printer. What will be a major consideration is that the Seikosha offers many of the features of much more expensive printers at quite a low price.

Dot-addressable graphics, for example, are standard, and resolve to 480 x 8 per horizontal row. A position feature allows multipass capability.

Indicator lamps signify power on and error conditions, while pushbutton controls are limited to stop and reset controls only. One serious omission is the lack of an online/local switch, which would allow the printer to remain on but disabled. Whether the printer is on or off, may be a moot point, however, as paper, once fed forward, cannot be fed in the reverse direction. This is annoying, and takes some getting used to.



The GP-250X printhead.

On the positive side, the printer does offer serial and parallel connection. The serial connection is via a 5-pin DIN connector, while the parallel connection is Centronics-style. A mode selection switch on the back of the printer selects for serial, parallel, or self-test mode.

Commodore offers a version of this printer as its new 1525 printer for the VIC-20 and Commodore-64 users. VIC and 64 owners should be aware, however, that the unconventional configuration of the Commodore 5-pin DIN is *not* compat-

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PRINTER PROFILE

Printer: Seikosha GP-250 X

Type: Dot matrix

Feed: Pin

Speed: 50 cps claimed

Interface: Parallel/serial (Centronics +5-pin DIN)

Density: 480 x 8

Graphics: Yes

Character Set: 4

Buffer: 480 bytes

Logic Seek: Yes, bidirectional

Summary: Some trade-offs, but still a good value

Price: $499

Manufacturer:

Axiom Corporation
1014 Griswold Ave.
San Fernando, CA 91340
(213) 365-9521

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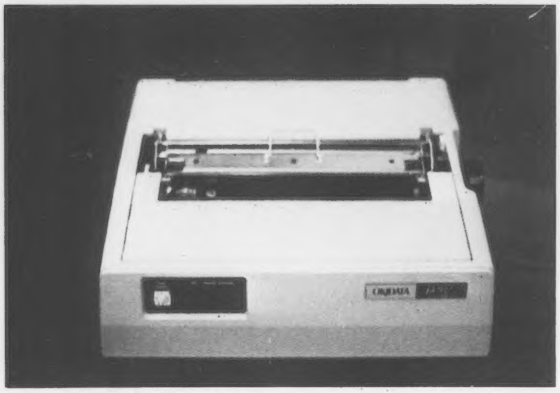

The Okidata Microline 92: a winner.

MPI PrintMate 99: made in U.S.A.

ible with the orthodox pin array on the Seikosha machine, and so a custom cable will be required.

The GP-250X offers one English character set, with the option to expand it horizontally and vertically. It also offers special British, German, and Swedish characters.

As stated earlier, the printer is slow, and slow form feed bogs it down yet further. The lack of a linefeed button was also missed.

The unit is quite compact, and really quite stylish, though it suffers from a severe case of "plasticitis." Don't drop this baby on a concrete floor—you'll be sweeping it up with a broom. In all fairness—you cannot expect such an inexpensive unit to be housed in a super-durable case.

The printer ribbon is in cartridge form, but the cartridge is one of the harder ones to change that we have seen. Fortunately, the manual is quite clear on the steps involved in changing the ribbon cartridge. In fact the documentation in general is very professional, and much better than we might have expected with such a unit.

As far as noise goes, the unit came in with a quite noisy 69 dB. It has a characteristic raspy quality to it as well, which was judged to be quite annoying. But this is nothing compared to the paper empty warning buzzer, which sent us running in all directions, to duck and cover. That was a feature we could have done without.

This review may seem highly critical, and though the Epson MX-80 probably remains a better $500 buy, the Seikosha is not a bad machine for the price. It merits a rating of two stars.

CIRCLE 400 ON READER SERVICE CARD

I wanted to acknowledge the help of Owen Linzmayer and Bob Beckman in the preparation of this article.

Okidata Microline 92

A Price/Performance Leader

One of the leading producers of small personal computer printers is Okidata. Their newest offering, the Microline 92, is a compact model which is nicely suited to household computer use.

The Microline 92 has a base unit sticker price of $699, making it a reasonably priced printer considering its performance capabilities. The basic printer has four built-in character sets and a 2K print buffer, and boasts a top print speed of 160 cps.

Under the hood.

When using the 92, you select between pin and friction feed. If you are using the pin feed rollers, the printer will accept only 10" fan-fold paper. The printer can be loaded from the top as well as from underneath. There is a small bracket located on the top of the unit which keeps the paper from wrapping back down inside of the feed slot—a common problem with other printers.

Hooking up the Microline 92 to your computer is very easy. The printer can be ordered with either a serial or a parallel interface. The one we reviewed had a Centronics parallel connector located on the back of the unit.

One thing that annoys me about the Microline 92 is that the entire casing must be removed to gain access to the DIP switch on which you select the various print options. Granted, there are only two screws that must be taken out, but we would rather not have to tear the printer apart every time we want to change an option.

The printhead has a density of 13 x 7 and can print 160 cps in the data processing mode, 50 cps in correspondence mode. The Microline 92 prints bidirectional and has true logic-seeking functions. Many people believe that these two

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PRINTER PROFILE

Printer: Microline 92

Type: Dot matrix

Feed: Pin/friction

Speed: 160 cps

Interface: Edgecard or Centronics parallel

Density: 13 x 17

Graphics: optional

Character Sets: 4

Buffer: 2K

Logic Seek: Yes, bidirectional

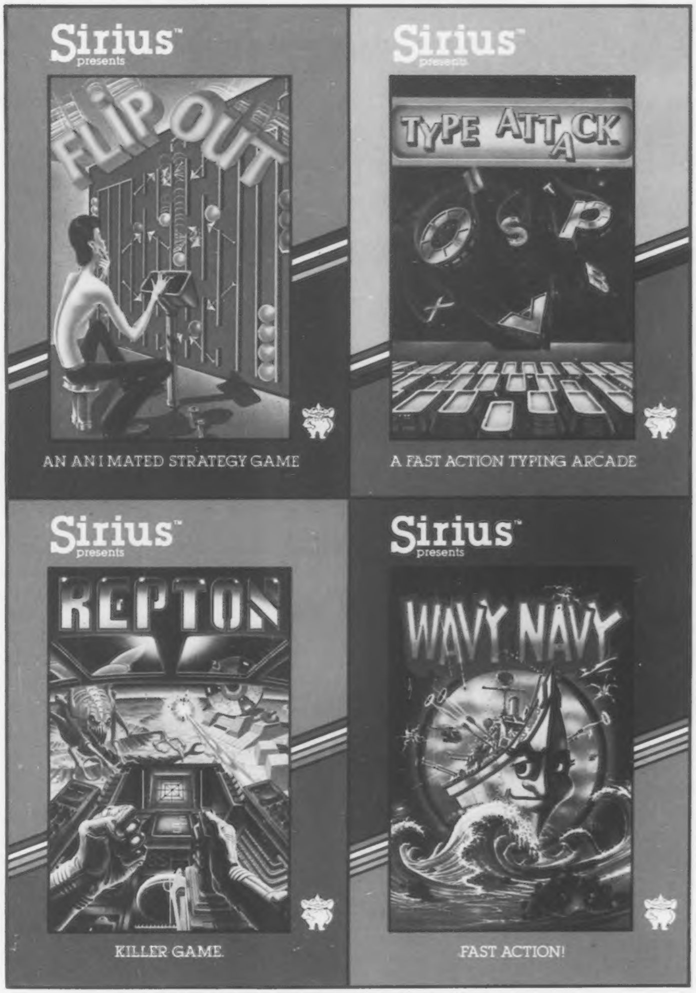
Summary: An excellent value.

Price: $699

Manufacturer:

Okidata Corporation
111 Gaither Dr.
Mount Laurel, NJ 08054
(609) 235-2600

Have A Great Playday!



Take your marble to the top. Pick your spot and let it drop. Hope for a flip instead of a flop. Once you get it, the fun never stops! It's FLIP OUT — a crazy new strategy game for one or two players. Each marble you drop causes a chain reaction, so take your time and plan carefully. Plan right and you'll flip, if you didn't you Flip Out!

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CIRCLE 269 ON READER SERVICE CARD

features make a printer fast, but the speed of a printer is really determined by how well it handles paper during throughput. The Okidata performs well in this area.

On the front panel of the Microline 92 there are four buttons, three lights, and a rotary dial. All of these are clearly labeled. The button second from the left is the "select" button. Hitting it switches you between on-line and local modes. To set the top of form, hold the TOF button down and move the paper manually to the desired position. Hit the form feed button at any time while you are in the local mode to advance the paper to the top of the next page. The rightmost button is the linefeed button.

If the printer runs out of paper, a red light on the front panel lights up and the printer stops. When the unit is on-line, the light above the select button is lit. So that you don't have to guess whether the printer is on, there is an easily visible power indicator located on the front panel. As long as the unit is plugged in and current is running through it, this light remains lit. The rotary length dial can be set to any one of ten positions. User-selectable form lengths range from 3"to 14".

The dot matrix print quality is very nice compared to other printers in the same cps range. There are four character sets, each with 96 characters, and the lower case letters have true descenders. In correspondence mode, the dots that make up each character are very close together, almost giving the appearance of fully formed characters. This printer uses an open spool ribbon which is difficult to thread and not as easy to handle as a cartridge ribbon found on other units.

For a printer of its small size, the Microline 92 is rather noisy. The Okidata clattered in with a raspy 72 dB noise level while printing. Although this is acceptable for a home environment, we wouldn't want to be on the phone in an office while it was printing. When the Okidata is turned on and waiting for you to use it, it makes no noise whatsoever. This is an appealing factor to those who like quiet while working on their computers.

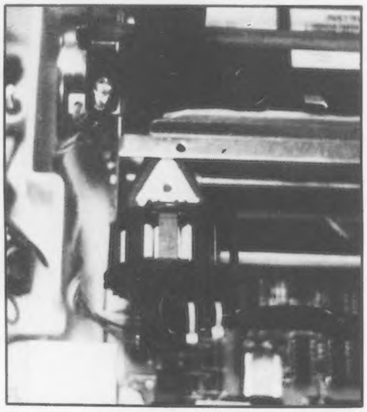
The Okidata Microline 92 is basically an enhanced version of the Microline 82 with the control codes of the Microline 84. Special features such as super- and sub-scripting make the 92 a perfect printer for the serious beginner. The printer is light-weight and very compact, and has a solid build. Its main market will probably be the home computer owner, since it has only limited office features. If you are looking for a reliable, quality printer for under $700, check out the Microline 92. It rates four stars.

CIRCLE 401 ON READER SERVICE CARD

MPI PrintMate 99

It Can Still Happen in the USA

The list price of the PrintMate 99 from Micro Peripherals Incorporated is $749. That it packs many features and has nice print quality for the price is all the more remarkable when you consider that its place of manufacture is not Osaka, but Salt Lake City. The PrintMate 99 proves that this country can remain highly competitive in the microcomputer printer contest.



Under the hood.

The printer is an impact dot matrix type with a maximum resolution of 17 x 9. It has a claimed speed of 100 cps and features a tractor feed. The paper loads from the bottom rear, and is more than a bit difficult to thread. It does not, however, require a slotted printer table.

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PRINTER PROFILE

Printer: MPI PrintMate 99

Type: Dot matrix

Feed: Tractor

Speed: 100 cps

Interface: Parallel/Serial, custom cable

Density: 17 x 9

Graphics: Yes

Character Sets: 2

Buffer: 1K

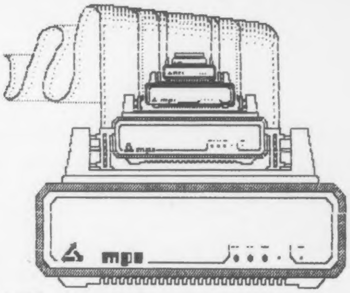
Logic Seek: Yes, bidirectional

Summary: Good quality text, graphics, and workmanship

Price: $749

Manufacturer:

Micro Peripherals, Inc.
4426 South Century Dr.
Salt Lake City, UT
(800) 821-8848



MPI self-portrait.

Unfortunately, interfacing to your specific machine may be tricky. Serial and parallel connection is offered, but only through a highly unorthodox internal connector. Apple owners will note with interest that MPI sells a cable, card, and software kit tailored specifically for connection to the Apple. This makes parallel connection a snap. MPI also offers a serial interface adapter. Our advice would be to forego the excitement of wiring this yourself. Take advantage of the ability to buy it directly from MPI.

The print quality of the PrintMate 99 is about average, but the graphics capability is well above average. The printer seems to have been designed with graphics applications in mind. The documentation is especially thorough in discussing graphics options.

As for its noise reading, the MPI unit turned out to be among the noisiest we tested. If a printer came in under 70 decibels, it passed our informal noise test. At 71 dB, the PrintMate 99 is among the four printers that failed, gaining the label "really pretty noisy." It is the kind of printer that stops arguments, shortens phone calls, and sends the cat into another room. This is its most disappointing feature.

The cartridge-based ribbon is not too difficult to replace, and the change can be made straightforwardly, without inking up fingers. The buffer is a slightly shrimpy 1K. We rated the unit at three stars.

CIRCLE 402 ON READER SERVICE CARD

8510A Prowriter

The Competition Is Running Well

If any low priced printer has a real shot at the reputation of the Epson, it is the C. Itoh Prowriter, and it is catching on fast. The unit we received several months ago quickly became the favorite of one of our colleagues. We can comment on the reliability of this machine: in four months of heavy use, it has yet to exhibit the slightest problem. The Prowriter is a real workhorse, deserving of its growing reputation.

Though we are not wholly sure it lives

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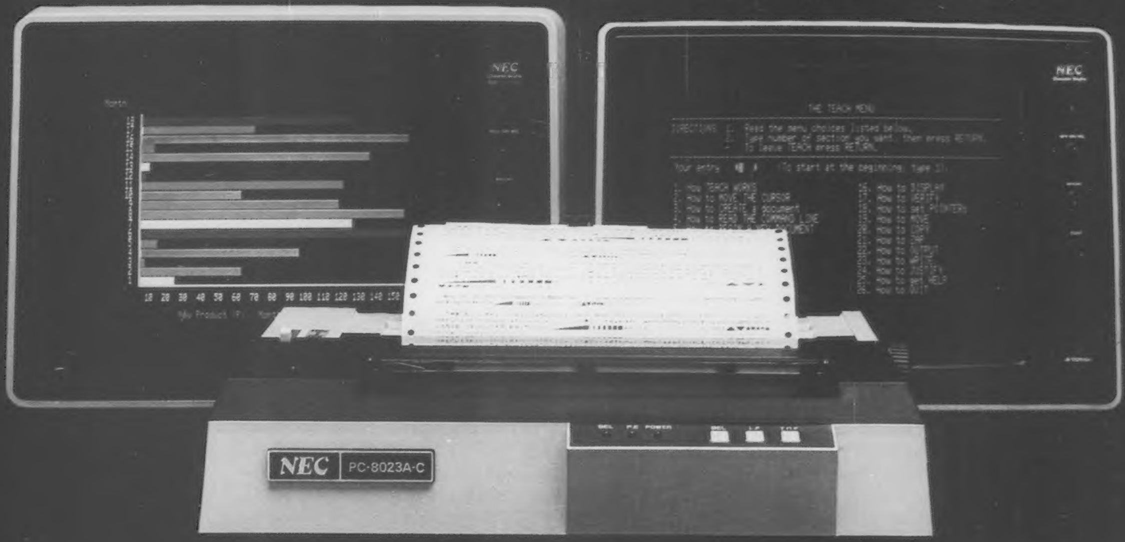

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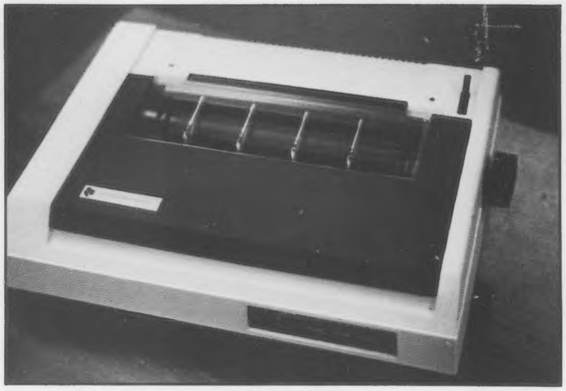
Personal Computer Division

Nippon Electric Co., Ltd., Tokyo, Japan

CIRCLE 215 ON READER SERVICE CARD

8510A Prowriter: drew raves.



IDS480 Microprism: impressively quiet.

up to its maker's claims of up to 120 cps, we can report that it is faster than most other impact dot matrix printers in its price range. At this speed, it delivers a crisp and classy 7 x 9 character set (but one of seven it can produce). It also offers bit addressable graphics.

The unit we received had a Centronics-standard parallel connector, and was quite simple to get going. A self-test feature is another added convenience. The cartridge ribbon is easily replaceable, and paper handling is about average, with familiar pinfeed, or friction feed for single sheets.

The buffer comes with a slightly paltry 1K standard, and the option to go to 3K. Front mounted LEDs indicate power on, paper empty, and on-line status. Pushbuttons allow for manual selection of on-line/local status, linefeed, and top-of-form access. These features add to the ease of use of the unit. The Prowriter is a sturdy machine, designed to keep costs low while maximizing reliability. Reliability is a feature that can't be ignored. The noise level of the Prowriter was measured at 69 dB, which is noisy but tolerable.

creative computing

PRINTER PROFILE

Printer: 8510A Prowriter
Type: Dot matrix
Feed: Pin/friction
Speed: Up to 120 cps
Interface: Centronics parallel
Density: 7 x 9
Graphics: Yes
Character Sets: 7
Buffer: 1K, with option for 3K
Logic Seek: Yes
Summary: Sturdy, serviceable, heavily discounted
Price: $795
Manufacturer:

C. Itoh Electronics
5301 Beethoven St.
Los Angeles, CA 90066
(213) 306-6700

The documentation is unfortunately somewhat lacking. Its outward appearance is professional-looking, but the information it contains is spread all over the place, in a rather unorganized manner. We will say that nearly everything you need to know is in there somewhere (along with lots you'll never need to know), but good luck finding it when you want to. It could have been done much better.

It is probably somewhat unfair of us to site the reliability of this machine, in light of the fact that the other printers have not been around long enough to allow us to pass similar judgment. But in our opinion it is a judgment worth passing on, and worth four stars in the bargain. We like this machine, and recommend it.

CIRCLE 403 ON READER SERVICE CARD

IDS 480 Microprism

Talk About a Look-Alike

Isn't that an MX-80 sitting there? Nope. wrong. It's a Microprism 480 from Integral Data Systems, better known as IDS. And at a list price of $799, it offers yet another alternative to its Japanese twin.

The 480 offers most of the same features as the Microline 92, MPI 99, Prowriter, and oter machines in the same price range. It features parallel and serial connections available on a single DB-25 connector. With a matrix density of 24 x 9, the print is very clear and pleasing. We like a font that includes serifs, as it more closely resembles fully formed character type. The Microprism default character set, while clearly dot matrix, does begin to approach that most famous of printer buzzwords: letter quality. And it does so at claimed speeds of up to 110 cps.

Single sheet friction feed, as well as pin feed are available on the 480. While single sheets feed well, we found the pin sprocket clamps awkward and liable to an occasional jam with fan-fold paper. Perhaps the paper we were using was simply too light for this machine.

The unit is a serviceable home printer, but certainly not a machine one would place in a busy office environment. It is on the "plasticky" side, and unlikely to survive extended abuse of any kind. Again, these are comments we would probably make of our venerable measuring stick, the MX-80, as well.

The Microprism was rated at 66 dB, which puts it among the quietest of the printers we tested, and makes it far and

creative computing

PRINTER PROFILE

Printer: IDS 480 Microprism
Type: Dot matrix
Feed: Pin/friction
Speed: Up to 110 cps
Interface: Parallel/serial
Density: 24 x 9
Graphics: Yes
Character Sets: 3
Buffer: 1.4K
Logic Seek: Yes
Summary: An Epson look- and work-alike.
Price: $799
Manufacturer:

Integral Data Systems
Route 13
Milford, NH 03055
(603) 673-9100

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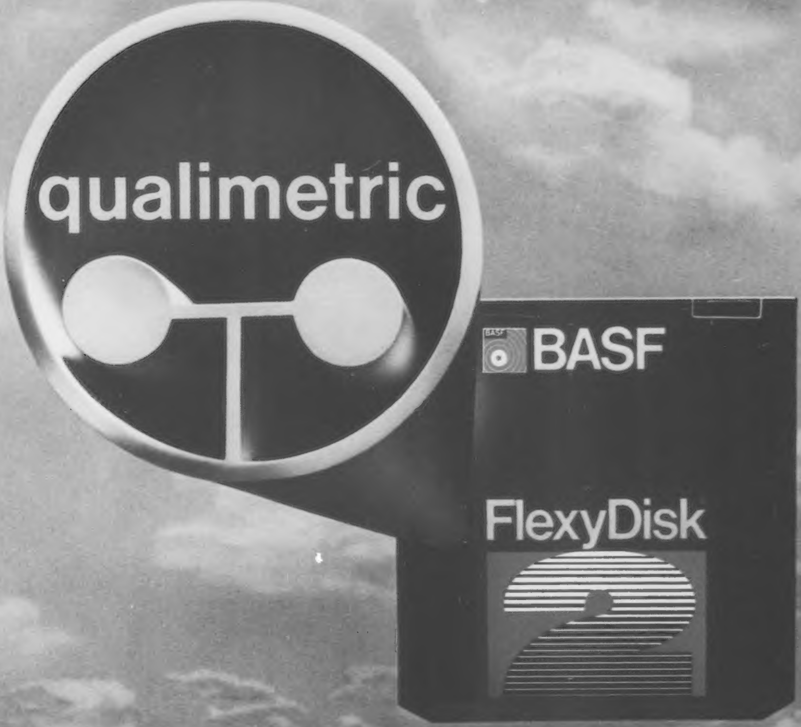

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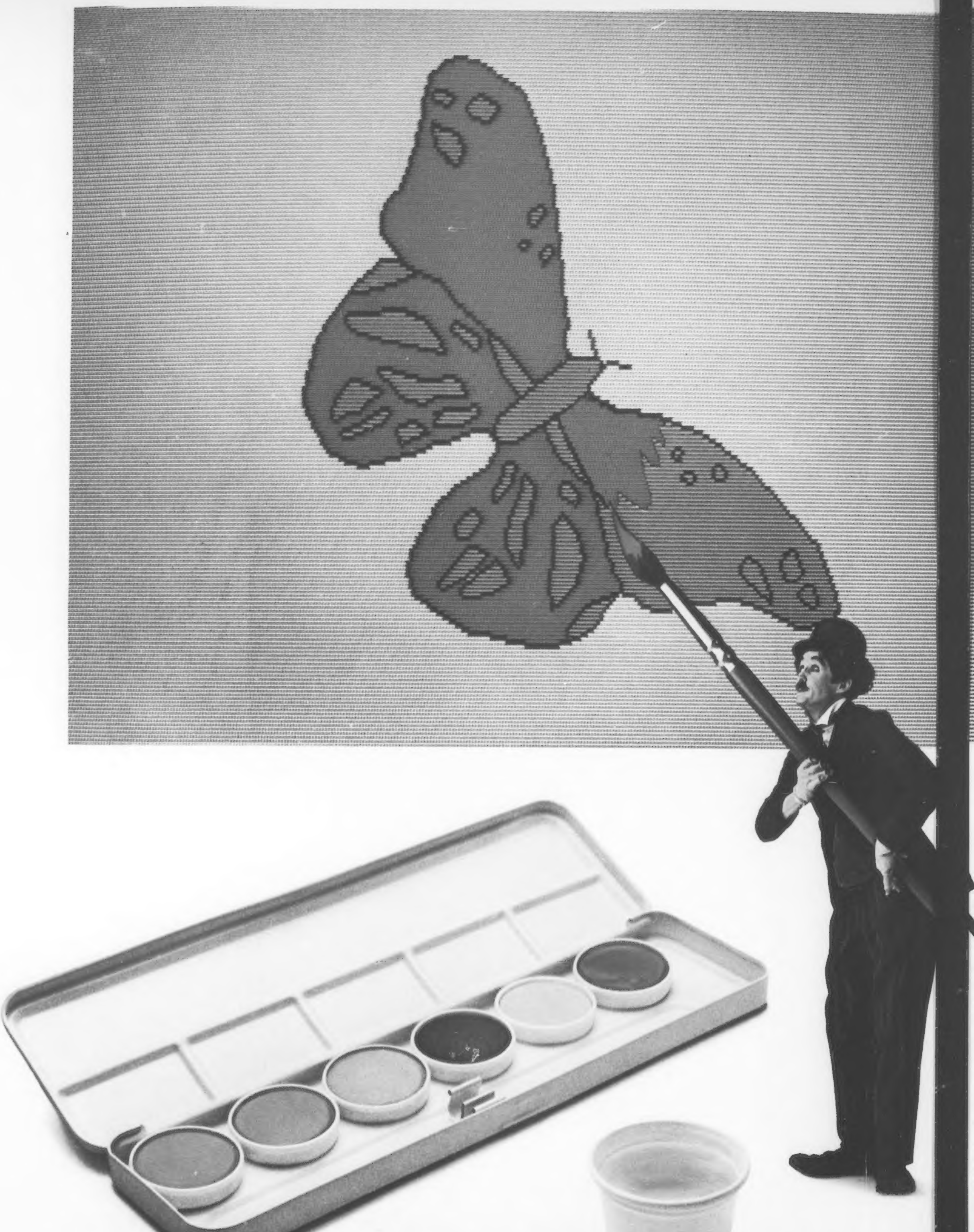

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10 function keys*
10-key numeric pad
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Power-on self testing*
Parity checking*
Display Screen
High-resolution*
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Upper and lower case
Green phosphor screen*
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CIRCLE 182 ON READER SERVICE CARD

Smith-Corona TP-1: disappointing.

MPI PrintMate 150G: programs easily.

away the quietest printer we tested that lists for under $1000. This is probably the strongest point of the machine.

IDS offers a number of printers, and this one is not its strongest entry, as we shall soon see.

We might have rated the Microprism a bit more harshly, but the low noise rating succeeded in keeping the printer in the three star range.

CIRCLE 404 ON READER SERVICE CARD

Smith-Corona TP-1

Hey, Where's the Rest of My Typewriter?

At a list price of $895, which can be heavily discounted, the SCM TP-1 is one of the least expensive daisy wheel printers on the market today. Question: How have they managed to do it? Answer: By creating a typewriter with a microcomputer interface instead of a keyboard. And in doing so, some very significant trade-offs were made.

Let's get the bad news right out into the open, then present the positive side. We are unhappy about a number of things concerning the TP-1—things that make its use somewhat less than enjoyable.

First, is its infernal racket. Our measured rate of 71 decibels does not sufficiently impart the sense of dread that quickly overcomes anyone in the same room with a printing TP-1. At first it reminded us of the old clacking teletype in the city room, with Perry White shouting "Great Caesar's Ghost" over the din. This image was short-lived, however. Within minutes it had dissolved into the roar of machine gun fire as our boys clawed inch-by-inch up hill 479. If you live in an apartment, running this printer for more than five minutes at a clip will constitute grounds for eviction.

Under the hood.

Ah, and we're only getting started. Unavoidably tied to this slight problem is another, the extremely slow speed of the TP-1. Remember how we mentioned above that manufacturers tend to exaggerate speed claims concerning their machines? Well Smith-Corona claims no more than 12 cps for its machine, and that in itself is generous. So you see, you must add to the infernal din the eternity it will take to stop.

creative computing
PRINTER PROFILE

Printer: SCM TP-1
Type: Daisy wheel
Feed: Friction
Speed: 12 cps
Interface: Specify serial or parallel
Density: n/a
Graphics: n/a
Character Sets: replaceable elements
Buffer: 120 bytes
Logic Seek: Yes
Summary: Only if you must have letter quality at a rock-bottom price.
Price: $895
Manufacturer:

Smith-Corona
Consumer Products Division
65 Locust Ave.
New Canaan, CT 06840
(203) 972-1471

A single-page, single-spaced letter will take up all of the five minutes allotted to an apartment dweller before the neighbors organize a vigilante group. Printing a 40-page document would most certainly qualify as cruel and unusual punishment. Taken together, the problems of noise and slow speed create quite a serious disadvantage. Though we joke here, in the long run it is really not very funny.

Then there are the petty problems. Like the fact that the printer is noisy even when it is waiting because of a low quality, high RPM fan that runs continuously. Like the fact that the printer can't run with its cover down. Like the fact that the unit throws off a lot of RFI (radio frequency interference). Like the fact that the unit cannot really handle continuous form paper, must be ordered in either 10 or 12 pitch models, and has a buffer of a measly 120 bytes.

Isn't there anything positive we can say about the TP-1? Yes, there certainly is. The print quality is impeccable—no dot matrix printer at even four times the price, yet comes close to the print quality of the TP-1. If fully formed character quality is what you are after, and you cannot afford anything else, then the TP-1 is the machine for you.

The cartridge ribbon is a snap to change. It is about the easiest changing ribbon we have seen. Likewise, changing print wheels is quite simple.

Daisy wheel printers are as a rule noisier and slower than dot matrix printers. They need not be nearly as slow or as noisy as the TP-1, but for the price, the unit still merits two stars.

CIRCLE 405 ON READER SERVICE CARD

MPI PrintMate 150G

Salt Lake Strikes Again

At a list price of $995, the PrintMate 150G is the last printer listing for under

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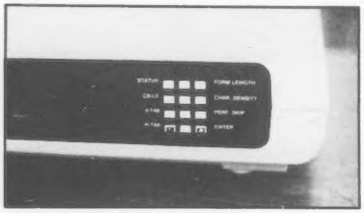
CIRCLE 168 ON READER SERVICE CARD

$1000 we shall consider here. It is in large part the 15" version of the PrintMate 99. and rather than repeat the same information, we urge readers interested in this printer to reread the specs of the model 99. We shall enumerate only the unique facets of the 150G here.

The PrintMate 150G looks like a pavilion left over from the 1965 World's Fair. It's so big you might consider climbing into it to load the paper. You'll have to devote quite a sizeable amount of space to the printer. But don't worry about losing desk space, because the 150 is a bottom-loading-only machine; it requires a slotted printer stand. (This is, by the way, a great way to sell slotted printer stands.)

The printer is about average in most respects, with a few exceptions. A command keypad allows swift and easy selection of alternate fonts, form lengths, pitches, horizontal and vertical tabs, vertical spacing, and other functions. The printer responds with musical prompts to indicate receipt of commands. This input approach is unique and sensible. We predict that we will be seeing it on more printers in the future.



150G command keypad.

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PRINTER PROFILE

Printer: MPI PrintMate 150G

Type: Dot matrix

Feed: Tractor

Speed: Up to 150 cps

Interface: Specify serial or parallel, custom cable

Density: 6120 dots/sq. inch

Graphics: Yes

Character Sets: 5

Buffer: 2K, optional to 16K

Logic Seek: Yes

Summary: Average features, but nicely priced.

Price: $995

Manufacturer:

Micro Peripherals, Inc.
4426 South Century Dr.
Salt Lake City, UT
(800) 821-8848

Under the hood.

The unit has no serious disadvantages, though there is nothing special about it, aside from the keypad that comes as standard equipment. We did dislike the plexiglass cover of the unit, which seemed a lot cheaper than it should have been.

The manufacturer rates the printhead at greater than or equal to 100,000,000 characters, which is an impressive claim. As for noise, the unit measured in at a very noisy 69 dB. Still, the PrintMate 150G is very competitively priced, and on that basis, we rated it at three stars.

CIRCLE 406 ON READER SERVICE CARD

Daisywriter 2000

Give Me Your Answer, True

The Daisywriter is our kind of fully formed character printer. It is relatively fast, relatively quiet, and relatively smart. It offers a 16K standard buffer, optional to 48K. It offers friction feed, with an option for tractor. Logic seeking, bidirectional printing, and efficient form handling make it a pleasure to use. And all of this comes for a list price of a mere $1395.

We like nearly everything about the Daisywriter, from its sturdy construction to its very complete documentation. With its front mounted controls and a page length calibrator similar to those found on the Okidata Microline series, the Daisywriter would be as at home in an office environment as it would be, well, at home. Paper handling is very accurate, and paper is likewise a snap to load. The ribbon cartridge looks to be the same as the one used on IBM Selectric typewriter, and is just as easy to replace. The noise rating of the Daisywriter was 68 db, which was quieter than seven of the dot matrix printers we tested.

About the only thing that got us down concerning the unit was hooking it up. It makes use of a 50-pin edge connection via a custom cable. Surely they could have done a bit better than that. Also, the machine is a little more plasticky than we would have preferred. Plasticitis is an insidious disease—it is striking everywhere nowadays.

creative computing
PRINTER PROFILE

Printer: Daisywriter 2000

Type: Daisy wheel

Feed: Friction, tractor as option

Speed: 20 cps

Interface: Parallel/serial 50 pin edge card

Density: n/a

Graphics: n/a

Character Sets: Replaceable element

Logic Seek: Yes, bidirectional

Summary: An excellent daisy wheel unit for the price

Price: $1395

Manufacturer:

Computers International
3540 Wilshire Blvd.
Los Angeles, CA 90010
(213) 386-3111

The print quality, as with other printers of its ilk, is unbeatable. And unlike the TP-1, any one Daisywriter can handle both 10 and 12 pitch daisy wheels.

More than the simple difference in their rated cps accounts for the fact that the Daisywriter is so much faster than the TP-1. The Daisywriter is smarter and handles paper much faster—these are considerations for which cps has not been known to account.

How unfair of us, you may be declaring aloud, to compare the TP-1 so unfavorably with the Daisywriter, without taking into account the disparity in their costs. The point is well-taken. What we are attempting to argue for is the following: if for your purposes true letter quality is mandatory, make the expenditure not only for letter quality, but for printer quality as well. The features available in the Daisywriter would have cost well over $2000 only about a year ago. They are well worth the cost of a Daisywriter.

If it had a Centronics connector, or a little less plastic and a little more metal, we would have rated it at four stars. As it is, it receives a well-deserved three.

CIRCLE 407 ON READER SERVICE CARD

Okidata Microline 84

Oki, but not Great

As was the case with the MPI machines, the Microline 84 is the big brother of the Microline 92, offering many of the same features along with 15" paper capability.

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INFOWORLD, Aug. 16, '82 The magazine's 'Software Report Card' rated JRT's documentation 'good' and performance, ease of use and error handling 'excellent'–the highest rating.

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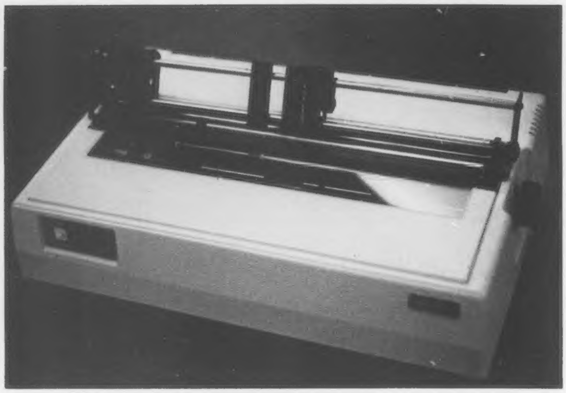
Daisywriter 2000: another winner.



Okidata Microline 84: overpriced?

Rather than lauching into a rehash. We suggest you take a look back at the 92 review to recall the major capabilities offered by this machine.

The most special feature of the 84 is its overhead tractors, which greatly facilitate paper positioning. This tractor assembly is shipped as a part of the standard package, but is left as an option to be installed by the user. If you will be feeding only cut sheets into the printer, you will not need the tractor assembly. But for continuous forms, installation is absolutely necessary. It takes only a few minutes and is well explained in the documentation.

As with the 92, the ribbon is spool mounted, making a ribbon change somewhat inconvenient. Paper feed can be from the back or through a slot on the bottom of the printer. This is a good feature; it is always advantageous to offer the user a choice. A single sheet feeder is also an available option, at extra cost.

The manual wins this year's "Most humorous Moment in Printer Documentation" award, in listing "TRS-80" alongside some other well-known languages (see Figure 1).

The machine is sturdily built in almost every respect, with the exception of the flimsy platen advance knob, which looks apt to break off in the user's hand.

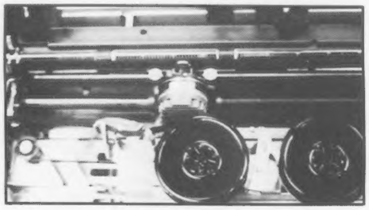
The Microline 84 is an extremely noisy machine. It rated a cacaphonous 75 decibel in our test, and had that raspy quality reminiscent of fingernails on a blackboard. That, combined with the rather steep list price, held the Microline 84 down to two stars. If it were to fall below $1100 and 70 dB, it could gain the other two.

CIRCLE 408 ON READER SERVICE CARD

Language	1	2	3	4	5	6	7	8	9	10	11
US ASCII	#	@	[	\	]	^	`	{	|	}	~
BRITISH	£										
GERMAN		§	Ä	Ö	Ü			ä	ö	ü	ß
FRENCH	£	à	°	ç	§			é	ù	è	¨
SWEDISH		É	Ä	Ö	Å	Ü	é	ä	ö	å	ü
DANISH			Æ	Ø	Å	Ü		æ	ø	å	ü
NETHERLANDISH			Æ	Ø	Å		°	æ	ø	å	
DUTCH	£			IJ					ij		
ITALIAN	£	§	°	ç	é		ù	à	ò	è	ì
TRS-80			↑	↓	←	→					~

Note: Differences among languages (Same as US ASCII if blank)

Parlez-vous TRS-80?



Under the hood.

creative computing
PRINTER PROFILE

Printer: Microline 84

Type: Dot matrix

Feed: Pin/friction

Speed: Up to 200 cps

Interface: Centronics parallel

Density: 9 x 9

Graphics: Yes

Character Sets: 10, even speaks TRS-80

Buffer: 2K

Logic Seek: Yes, bidirectional

Summary: If only it were quieter and cheaper

Price: $1395

Manufacturer:

Okidata Corporation
111 Gaither Dr.
Mount Laurel, NJ 08054
(609) 235-2600

Integral Data System Prism 132 Printer

One of the newest advances in the home computer field is the introduction of four-color printers. The Prism 132 printer from IDS has the ability to make hardcopy screen dumps of hi-res color graphics in addition to producing high quality character printouts.

The 132-column Prism we reviewed came equipped with two options which make it possible to use the color graphics capabilities of the printer. These options are the Prism Color board, and the Dot Plot Graphics chip. Combined, these two options boost the cost of the printer by $498.

The Prism Color option gives you the ability to print standard text in any of the selectable fonts, using a four-color ribbon for highlighting or emphasis. The Dot Plot Graphics option can be coupled with Prism Color to allow you to print color dot-addressable graphics. Neither option is needed to run the Prism as a regular printer.

The basic unit price of the Prism 132 was recently raised to $1499 because the new printers have been enhanced by the addition of extra features. One reason for this increase is that new Prism print buffers have been enlarged to 3.4K. In addition, IDS has made their Sprint speedup option standard on all modes. The manufacturer claims that with the Sprint kit installed and selected, the printer can spit out 200 characters per second. This is quite an improvement considering that the old unit had a 110-150 cps ceiling.

The Prism 132 offers both serial and parallel interfaces using a single DB-25 connector located on the back of the system. When properly interfaced to a microcomputer, the Prism is simple to use and understand. The adjustable tractors can be set to accept paper from 3"to 15"in width making it possible to print on mailing labels, as well as the largest fan-

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HEWLETT PACKARD

CIRCLE 180 ON READER SERVICE CARD

The Proof is in the print-out

What follows is a comparative look at the character sets of each of the printers we have reviewed. In some cases every printer font is shown. In others character sets may have been omitted.

While comparisons such as these can be helpful in selecting a printer, some caution is advised. Samples have been reproduced at 100% of their actual size, but reproduction here necessarily alters their appearance slightly.

Seikosha GP-250X

```
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
```

Microline 92

```
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuvw
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuvw
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuvw
```

MPI PrintMate 99

```
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefgh
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvw
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~!"#$%&'()*+,-./0123456789:;<=
```

8510A Prowriter

```
 !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefgh
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghi
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghij
```

IDS 480 Microprism

```
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefgh
qrstuvwxyz{|}~▦ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWX
abcdefghijklmnopqrstuvwxyz{|}~▦ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGH
```

SCM TP-1

```
0123456789:; = ?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[  ]_@abcdefghijklmnopqrstuvw
0123456789:; = ?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[  ]_@abcdefghijklmnopqrstuvw
0123456789:; = ?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[  ]_@abcdefghijklmnopqrstuvw
```

MPI PrintMate 150G

```
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefg
qrstuvwxyz{|}~▦ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVW
abcdefghijklmnopqrstuvwxyz{|}~▦ !"#$%&'()*+,-./0123456789:;<=>?@ABCDEFG
```

Daisywriter 2000

```
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[±]²_°abcdefghijklmno
pqrstuvwxyz¼½¶§!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[±]²_°
abcdefghijklmnopqrstuvwxyz¼½¶§!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQ
```

Microline 84

```
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
```

Prism 132

```
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuvw
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuvw
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuvw
```

Prism 132

```
                    ***** ALL PRINTABLE ASCII CHARACTERS *****
?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~▦ ! "" # $
BCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcde
&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOP
tuvwxyz{|}~▦!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
XYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~▦!"#$%&'()*+,-./0123456789:;<=>?@ABC
]^_`abcdefghijklmnopqrstuvwxyz{|}~▦
```

Prism 132

```
?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~▦ ! " # $
B C D E F G H I J K L M N O P Q R S T U V W X Y Z [ \ ] ^ _ ` a b c d e
& ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ? @ A B C D E F G H I J K L M N O P
t u v w x y z { | } ~ ▦!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_
XYZ[\]^_`abcdefghijklmnopqrstuvwxyz{|}~▦! " # $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ? @ A B C
 ^_`a b c d e f g h i j k l m n o p q r s t u v w x y z { | } ~ ▦
```

Prism 132

```
#£<=@[\]^`{|}~£$<=à°ç§^`éùèè£$<=à°ç§^`éùèè#$<=@ÆØÅ^`æøå~#$<=@ÆØÅ^`æøå~#$
<=§ÄÖÜ^`äöüß#$<=§ÄÖÜ^`äöüß#$<=ÉÄÖÅÜéäöåü#$<=ÉÄÖÅÜéäöåü#$úa@ñ
```

Silentscribe DP-9620A

```
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuvwxyz
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuvwxyz
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuvwxyz
```

Qantex 7030 (180 cps "Draft" mode)

```
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
```

Qantex 7030 (150 cps "Compose" mode)

```
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
```

Qantex 7030 (75 cps "Correspondence" mode)

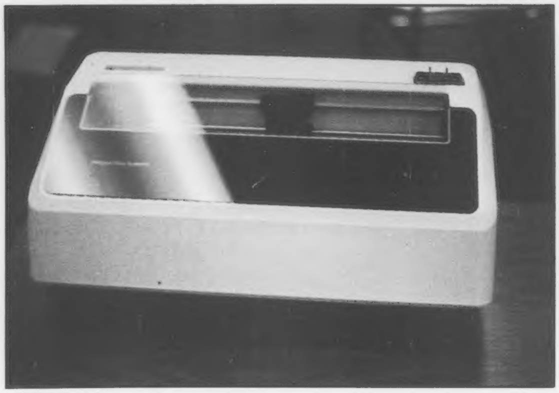
```
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
```

Qantex 7030 (37 cps "Dual pass" mode). State-of-the-art in dot matrix.

```
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_@abcdefghijklmnopqrstuv
```

Siemens PT80 (Model 2712)

```
!"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefgh
"#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghi
#$%&'()*+,-./0123456789:;<=>?@ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghij
```



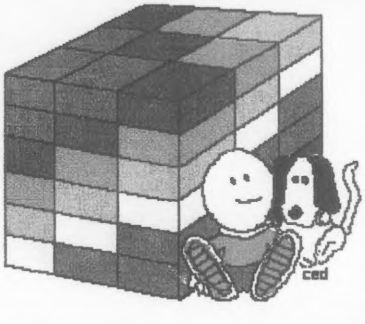
IDS Prism 132: very versatile.

Anadex Silentscribe DP9620A: a smarty.

fold paper available. All paper is loaded from the rear, toward the very bottom. Like other printers which are fed from the back, the Prism has a tendency to wrap the printed paper into the loading slot unless you take care to drape it over the front of the unit.

After hooking up the Prism to our Apple II+, we decided to make a color screen dump of a cartoon that had been submitted on a diskette. We simply loaded the binary screen file into memory and consulted the manuals to find the correct commands to activate the printer.

In the four-color graphics mode the printhead starts on the left. It prints the first color on the ribbon, and then returns to the start of the same horizontal line. Once the printhead is repositioned, the ribbon is raised so that the next color to be printed is in front of the printhead. This cycle repeats until all four colors have been printed; the paper is then advanced.



creative computing

PRINTER PROFILE

Printer: Prism 132
Type: Dot matrix
Feed: Tractor
Speed: Up to 150 cps
Interface: Serial/parallel
Density: 24 x 9
Graphics: Yes, four color
Character Sets: 6
Buffer: 1.5K
Logic Seek: Yes, bidirectional
Summary: A star for each color.
Price: $1499
Manufacturer:

Integral Data Systems
Route 13
Milford, NH 03055
(603) 673-9100

It took only a few minutes for the printer to finish the entire medium-sized screen dump. We were impressed—the registration of the paper was so good that there were no gaps between lines of print. The colors all came out vividly and sharply. The Prism is such a convenient way to get "photos" of hi-res graphics screens, we had to remind ourselves that it can also function as a high-speed conventional printer.

Prism printers have the ability to print 150 cps. The characters are dot matrix with true descenders, and the matrix has a density of 24 x 9. The quality of the printed characters is very good—the dots are so close together that the letters almost appear to be fully-formed. When the Prism runs in draft (Sprint) mode, it can print over 200 cps, but quality is sacrificed.

Resident in the basic Prism printer are seven international character sets plus the standard U.S. character set. To select a character set other than the default, you can either reconfigure the printer with a jumper or change a parameter through software.

Other specifications that you can configure through software include print density, fixed and proportional spacing, justified text, intercharacter spacing, and line spacing.

The Prism is well padded on the inside in an attempt to reduce the noise while printing. When running at full speed with all of the covers in place, the Prism emits a noise level of 68 dB. This is slightly above the average we found for other dot-matrix printers.

The Prism 132 is a very versatile printer with many things going for it. The main appeal of the unit obviously is its ability to print four colors and hi-res dot-addressable graphics. If you have a need for computer generated charts or pictures,

Pkaso Interface Card

Lately we have been making extensive use of the Prism printer to obtain Apple II+ color hi-res screen dumps. None of this would have been possible without the aid of the Pkaso Apple interface card from Interactive Structures.

The interface card allows you to use the dot-addressable color graphic features of a fully equipped IDS Prism printer. Although Integral Data Systems has yet to introduce their own Apple interface card, Interactive Structures has had the Pkaso card on the market for several months now.

The Pkaso interface card has special features which similar products do not. According to the manufacturer, only the Pkaso has the ability to produce both low- and hi-res color screen dumps, all of which can be printed in a variety of shapes and sizes. The Pkaso printer interface is very impressive when you realize it can also handle gray-scale.

The small Pkaso interface card for the Apple II+ costs $175 and comes complete with a 4' cable, a disk of software, and a 52-page user's manual. A similar package for the Apple III costs $205.

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CIRCLE 126 ON READER SERVICE CARD

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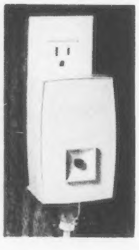

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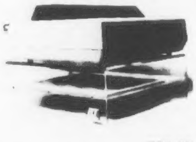

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CIRCLE 118 ON READER SERVICE CARD

Qantex 7030: the Mercedes of matrix.

Siemens PT80/2712: nearly affordable.

this printer with the special options would be an excellent choice. The base price is a bit too high if you need only a conventional printer. Nevertheless, if you buy an IDS for its graphics capabilities, you need not purchase a separate printer specifically for text hardcopy.

We rated it a four star value.

CIRCLE 409 ON READER SERVICE CARD

Anadex Silentscribe DP-9620A

An Office Workhorse

The Silentscribe is easily the most impressive-looking printer we have ever seen. It looks like some sort of vehicle that is about to fly off the table and into deep space. But beauty is only shell-deep, you know. And with a list price of $1845, the machine has a lot to live up to.

creative computing

PRINTER PROFILE

Printer: Silentscribe DP-9620A

Type: Dot matrix

Feed: Tractor

Speed: Up to 200 cps

Interface: Parallel/serial

Density: 72 x 72

Graphics: Yes

Character Sets: 5

Buffer: 1.5K

Logic Seek: Yes, bidirectional

Summary: Not so silent, but still high quality.

Price: $1845

Manufacturer:

Anadex, Inc.
9825 DeSoto Ave.
Chatsworth, CA 91311
(213) 998-8010

First there is this silence business. The Silentscribe measured in at 64dB, which is admittedly the quietest of all the conventional printers we tested. But 64 dB is not silence, nor quiet, nor even a low rumble. It is noise. When the phone rings next to Silentscribe, you'll want to turn the printer off.

The Silentscribe is an extremely solid and well-built machine, giving the appearance of a unit with high reliability. It is also quite intelligent. In the self-test mode, it lists in binary the default configuration of all DIP settings. This is an advanced and very thoughtful feature. The Superscribe will notify you of all switch settings as well as checking its own ROM and RAM.

The machine is another bottom-only loader, necessitating a slotted stand, and making paper loading somewhat inconvenient. Tractor feed, once established, is rapid and sure.

Print quality is quite good, approaching letter quality. There is easy access to all front panel controls, but the rear DIP switches are another story. They are recessed into narrow slots in the bottom rear of the printer—designed to be set once and then forgotten, I suppose.

The buffer is only 1.5K, with an option to expand to 2K. This is surprisingly small.

The Silentscribe is without a doubt a high quality machine, but for nearly $2000, one might have expected more (as we shall see). For that reason, we gave the unit a rating of two stars.

CIRCLE 410 ON READER SERVICE CARD

Quantex 7030

Is It Live, or Is It Matrix?

What's built like a tank, weighs 42 lbs., and proves that you can still find real quality in an American-made product? That's easy: the Qantex 7030 printer. Sure, it lists for $1995, but what would you be willing to pay for a machine that is really built to take it, while producing state-of-the-art, truly letter quality dot matrix print at a rate of 37 cps? If we were shopping for a quality printer on which to heap some real abuse, this baby would be our choice.

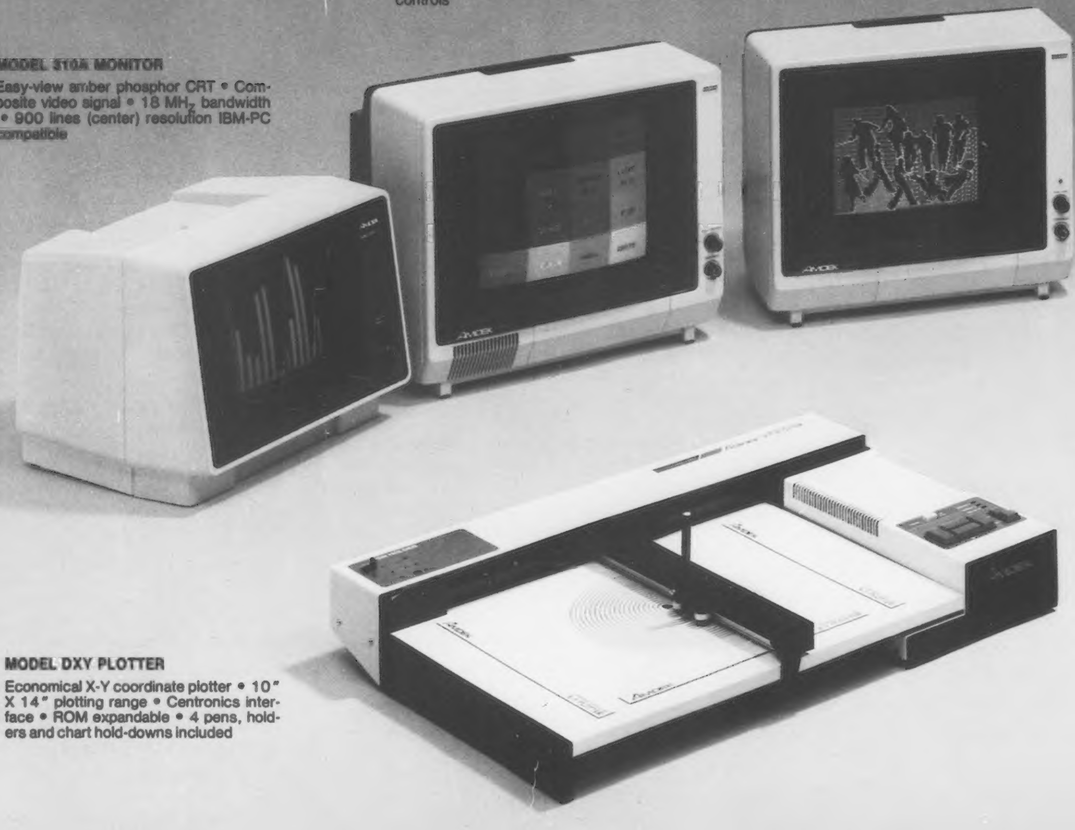
Qantex under the hood.

Talk about metal. This printer makes use of metal. Remember metal? That's the stuff they had to use before there was plastic. The Qantex uses it, and uses it liberally. We have never seen a more solid machine. Its cover slams like the door of a BMW.

Offering parallel and serial connection in our preferred Centronics and DB-25 formats, the unit provides very clean print varying from 37 to 180 cps modes. The claimed 150 cps mode looks about as good as the 60 cps mode on other dot matrix printers. At 75 cps, we gained serifs and a very tight matrix. At a dual pass 37 cps, we got a matrix nearly indistinguishable from daisy wheel print. Examine it yourself. It is really quite impressive.

All options are easily selected from the front or rear of the printer. There is relatively easy access even to the configuration DIPs, which we found extremely refreshing. Paper can be loaded from the front or the bottom, very simply and

AMDEK...your guide to



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IBM-PC	●	●	●	●	*	●	*	●	●	* Special Cabling Required
APPLE III	●			*	*	*	*	●		* Special Cabling or Converter Required
APPLE II	●		●	*	*	*	*	●	●	* DVM Board Required
ATARI 800	*		*							* Opt. Atari Cable Required
VIC-20			*							* Opt. VIC Cable Required
TRS-80	*									* Opt. TRS Cable Required
Osborne	*									* Opt. Interface Required
TI-99			*							* Opt. TI Cable Required
Commodore-64	*		*							* Opt. Commodore Cable Req.

innovative computing!

COLOR-III MONITOR

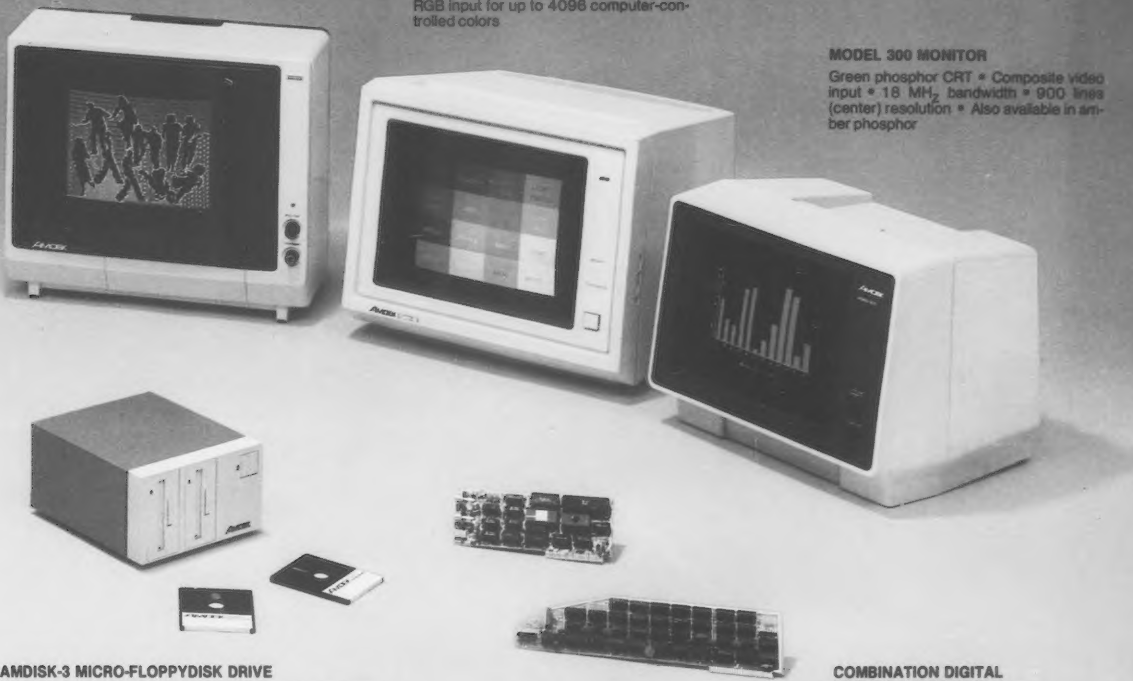
Economical RGB input monitor • 260(H) X 300(V) line resolution • 80 X 24 character display capability • Commercial grade CRT

COLOR-IV MONITOR

Superior 720(H) X 420(V) line resolution • 80 X 24 character display • analog RGB input for up to 4096 computer-controlled colors

MODEL 300 MONITOR

Green phosphor CRT • Composite video input • 18 MH$_z$ bandwidth • 900 lines (center) resolution • Also available in amber phosphor



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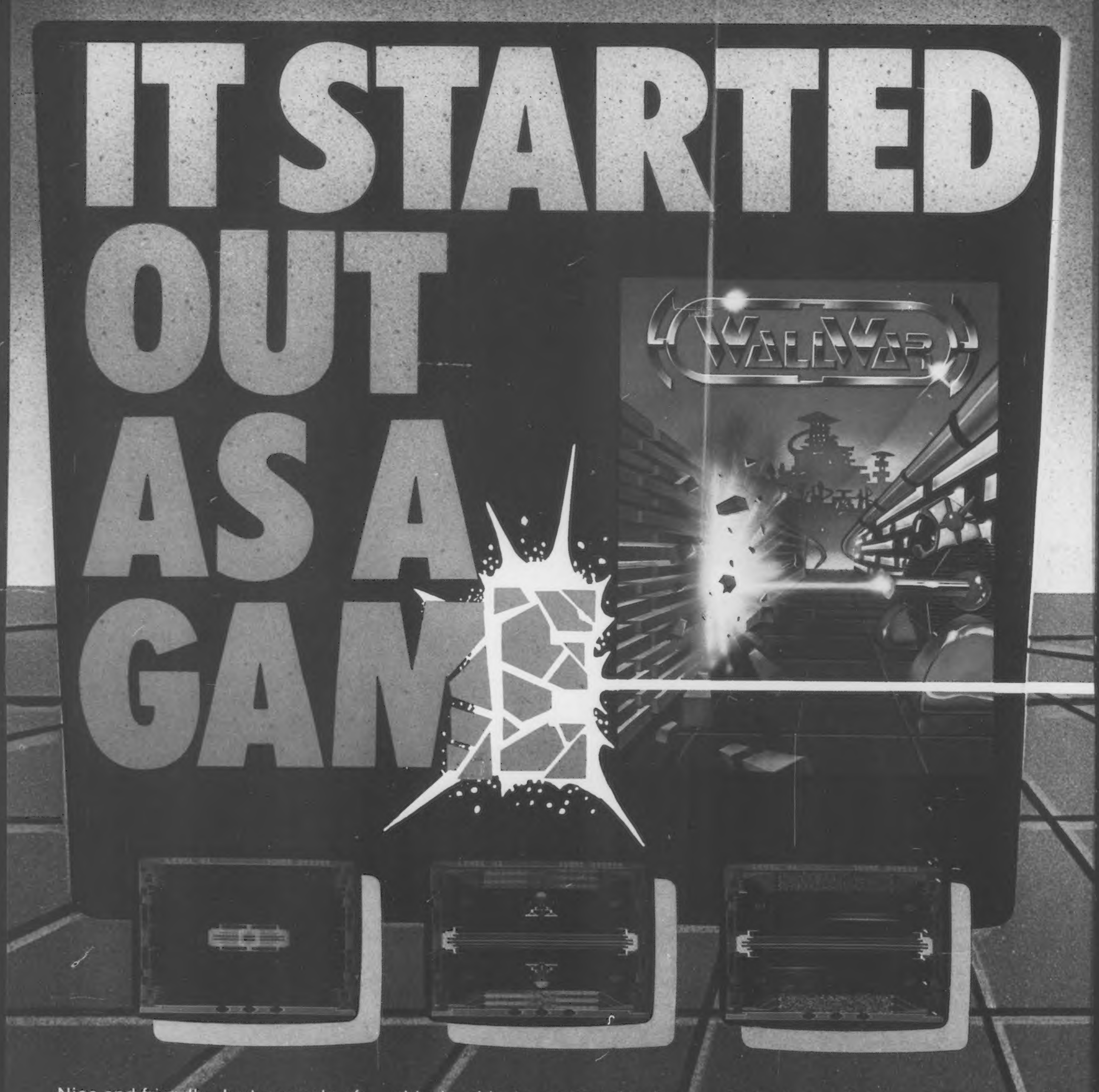
CIRCLE 106 ON READER SERVICE CARD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CIRCLE 253 ON READER SERVICE CARD

Sierra ON-LINE INC

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PRINTER PROFILE

Printer: Qantex 7030
Type: Dot matrix
Feed: Tractor
Speed: Up to 180 cps
Interface: Centronics parallel/DB-25 serial
Density: 144 x 144
Graphics: Yes
Character Sets: 4
Buffer: 4.7K
Logic Seek: Yes, bidirectional
Summary: State-of-the-art impact dot matrix.
Price: $1995
Manufacturer:
North Atlantic Industries
60 Plant Ave.
Hauppauge, NY 11788
(516) 582-6060

straightforwardly. The cartridge ribbon is also easy to change.

The 7030 is a tractor-only printer—which seems a shame in light of its incredible print quality capability. Its noise rate was measured at a tolerable 67 dB.

The documentation is thorough and clear. Programming the printer is made easy.

If you are looking for speed and high quality print in a high quality printer, look no further. The Qantex is exactly what you are looking for, assuming you can afford it. And it's made in the USA. It gets three stars. It will get another when it drops $400 in list price.

CIRCLE 411 ON READER SERVICE CARD

Siemens PT80/2712

Its Time is Nearly Here

You may have noticed that we have been using the phrase "under the hood" to caption photos of printer innards. The cover of the Siemens 2712 (neé PT 80) truly opens up like the hood of a car. It's only fitting, too: the printer costs practically as much as a car, listing for $3225. This price will surely drop—at least we expect it to—as ink jet printer production expands.

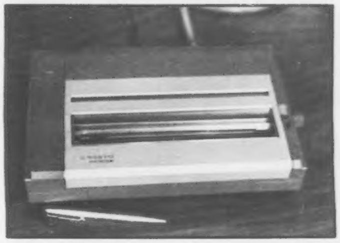
When we first examined the print quality of the Siemens unit, we were unimpressed. The matrix seemed blurry and ill-defined. We then learned from the thorough documentation that the printhead must be cleared at the start of each printing session. This is accomplished very simply by allowing the self-test to run for a couple of minutes so the printhead jets can clear up, evening their flow. The print quality then improves dramatically, though it always remains recognizable as dot matrix.

Rather than print quality, the really impressive things about the Siemens unit are its speed and its noise rate. At a staggering 270 cps, with a very quick linefeed, the unit registered 55 decibels. This represents a noise level of less than half that of nearly all the other printers we have examined. The sound is more like that of the windshield wipers in a Volkswagen than the sound of a microcomputer printer.

The ink jet head itself is very easy to remove, though as one might expect, the ink can be somewhat messy. However the manufacturer states that the life of an ink cartridge is typically greater than or equal

Siemens under the hood.

A Truly Pretty Printer



The PHC 8000-P is the smallest fully-formed character printer ever offered.

In July of 1982, Sanyo introduced a portable computer called the PHC-8000. It is a multi-featured handheld machine, aimed squarely at the data communications market. On a recent visit to Sanyo, I got a chance to look at it, along with some other goodies the company is readying for release.

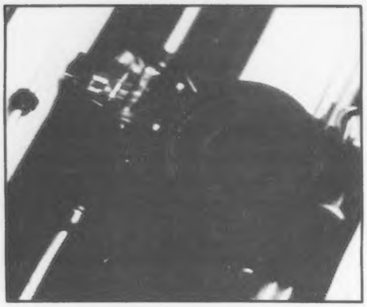
Among these was an utter jewel—a truly exciting new product. It was a printer prototype called the PHC-8000P, although I was warned that the model number might change soon. Granted it is remarkable enough that the PHC-8000P is an impact printer that will list for under $500. The really interesting thing about it is its diminutive size: a mere 12 x 7 1/2 x 2 1/4" (see photo).

Although designed to complement the PHC-8000 handheld unit, the PHC-8000P will sport a Centronics-compatible parallel connector, for easy interfacing to other microcomputers. I saw a working prototype smoothly handle 8 1/2 x 11" single sheet bond paper, and produce letter quality print at a rate of 20 cps, which is a bit faster than many full-size fully-formed character printers. The unique, barrel-shaped plastic print head produced unerring character registration, though the printer proved a bit noisy during use. This is an understandable trade-off considering its extremely small size.

With its incredible portability and very reasonable price, the Sanyo PHC-8000P may become one of the year's big contenders. It could usher in yet another revolution to an already fast-changing market.

Yukio Sakaguchi, Project Engineer, and one of the designers of the unit. To his right is Arthur Shebar, Sanyo's national Sales Manager.

The PHC 8000 is the handheld personal computer that mates with the PHC 8000-P, although interfacing other machines will be possible.



Ink-jet printhead.

creative computing

PRINTER PROFILE

Printer: PT 80 (Model 2712)
Type: Ink jet
Feed: Friction, holds paper roll at rear
Speed: Up to an impressive 270 cps
Interface: Parallel/serial custom cable
Density: 140 dots/inch horiz., 85 dots/inch vert.
Graphics: As an option
Character Sets: 8
Buffer: 2K with option for 8K
Logic Seek: Yes, bidirectional
Summary: A marvel of German precision.
Price: $3225
Manufacturer:

Siemens Corporation
240 E. Palais Rd.
Anaheim, CA 92805
(714) 991-9700

to 5,000,000 characters. That would mean the printhead would need replacement quite infrequently.

As for the reliability of the unit, frankly we would feel a bit queasy laying out so much money for a technology so new. We had some problems getting the machine up and running—problems ranging from an ill-fitting power cord to faulty interfacing information from customer support. Though these problems were solved very quickly, the indication is that the bugs aren't totally out yet. We guess that at press time only about ten people in this country, perhaps fewer, were truly qualified to service the Siemens unit. That is not enough of a support organization to satisfy us.

Ink jet technology is nonetheless here to stay, and the Siemens PT80/2712 printer will probably be with us for quite a while as well. It certainly runs like a charm now. It merits a two star rating. ☐

CIRCLE 412 ON READER SERVICE CARD

Printer	Price	Type Density	Interface and Connector	Feed	Claimed Speed
Anadex DP-9620A Silentscribe	$1845	Dot Matrix 13 × 9	Multiple Serial and Parallel (Centronics and DB25)	Tractor	120-200 cps
C. Itoh 8510 Prowriter	$795	Dot Matrix 7 × 9	Parallel (Centronics)	Tractor and Friction	120 cps
Daisywriter 2000	$1395	Daisy Wheel	Serial and Parallel (Custom Cable)	Friction (Tractor Option)	20 cps
IDS 480	$799	Dot Matrix 24 × 9 Maximum	Serial and Parallel (DB-25)	Pin	110 cps
IDS Prism 132	$1499	Dot Matrix 24 × 9 Maximum	Serial and Parallel (DB-25)	Tractor	150 cps
MDI 99G	$749	Dot Matrix	Serial or Parallel (Centronics or DB-25)	Pin	100 cps
MPI 150 G	$995	Dot Matrix 11 × 9	Serial or Parallel (Centronics or DB-25)	Pin	150 cps
Okidata Microline 84	$1395	Dot Matrix 13 × 17	Centronics Parallel	Tractor and Friction	200 cps
Okidata Microline 92	$699	Dot Matrix 13 × 17	Centronics Parallel	Pin	160 cps
Qantex 7030	$2995	Dot Matrix 24 × 18	Multiple Serial and Parallel (Centronics at DB-25)	Tractor	180 cps
Seikosha GP-50X	$499	Dot Matrix	Multiple Serial and Parallel (Centronics and 5 Pin DIN)	Pin	50 cps
Siemens PT-80	$3225	Ink Jet	Multiple Serial and Parallel (Custom Cable)	Friction	270 cps
Smith Corona TP-1	$895	Daisy Wheel	Specify Serial or Parallel (Centronics)	Friction	12 cps

Graphics	Maximum Width	Character Sets	Descenders	Buffer	Logic Seeking	Pitch	dB at 1 Meter	Overall Rating
Yes	132 columns at 10 cpi 15″	5	Yes	2K	Yes Bidirectional	10 to 16.4 cpi	64dB	**
Yes	80 columns at 10 cpi 9½″	6	Yes	2K	Yes Bidirectional	6 to 17 cpi	69dB	****
No	132 columns at 10 cpi 15″	Replaceable Wheels	Yes	16K (48K Option)	Yes Bidirectional	10 or 12 cpi	68dB	***
Yes	132 columns at 16.8 cpi 9½″	3	Yes	1.4K	Yes	10 to 16.8 cpi	66dB	***
Yes	132 columns at 10 cpi 15″	8	Yes	1.5K	Yes Bidirectional	10 to 16.8 cpi	69dB	****
Yes	132 columns at 17 cpi 9½″	2	Yes	1K	Yes	10 to 17 cpi	71dB	***
Yes	132 columns at 10 cpi 15″	5	Yes	2K	Yes	10 to 17 cpi	69dB	***
Yes	132 columns at 10 cpi 15″	4	Yes	2K	Yes Bidirectional	10 to 17 cpi	75dB	**
Yes	132 columns at 17 cpi 9½″	4	Yes	2K	Yes Bidirectional	10 to 17 cpi	72dB	****
Yes	132 columns at 10 cpi 15″	4	Yes	4.7K	Yes Bidirectional	10 to 17.1 cpi	67dB	***
Yes	80 columns at 10 cpi 9½″	1	Yes	480 Bytes	Yes Bidirectional	10 cpi	69dB	**
Yes	132 columns at 10 cpi 15″	8	Yes	2K	Yes Bidirectional	10 to 16.5 cpi	55dB	**
No	126 columns at 10 cpi 15″	Replaceable Wheels	Yes	120 Bytes	Yes	10 or 12 Pitch Models Available	71dB	**

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computing
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evaluation

Quadram MicroFazer Data Buffer

David H. Ahl

The Quadram MicroFazer is a self-contained data buffer that connects between a computer and a printer. The MicroFazer receives data from the computer at a high speed (up to 4000 characters per second). It stores these data in its own memory, then feeds the data to the printer as the printer can handle them. This buffering action means that you need not tie up your computer while printing a lengthy document.

Time Saving

Does the MicroFazer really save time? You bet. An article written in-house for *Creative Computing* is either transcribed by a secretary from a dictation tape on a word processor or written directly on one. This first draft is then corrected by the author and printed out a second time. It is then routed around to the other editors for comments, changes, and corrections. Following that process, it is printed out again.

One article I wrote recently was 4178 words long. A double-spaced printed version ran 17 pages and took 11 minutes and 40 seconds to print (about 40 seconds per page) on an Epson MX-80 printer. Do the arithmetic and you will find that this is a print speed of about 44 characters per second, slightly over one-half of the rated 80 cps speed of the Epson. We found this differential true across the board in our printer evaluations. Hence, speeding up the printing process may be more worthwhile than published figures might lead you to believe.

In any event, the 4178-word document was transferred to the MicroFazer in about 15 seconds. The computer was then no longer occupied with the printing process and was free to do something else. On the three printouts of this article, the MicroFazer saved 35 minutes of computer time, a significant saving indeed.

The computer time necessary for printing with and without MicroFazer is in a ratio of about 46:1 with Epson and other dot matrix printers in the 80 cps speed range. The savings are proportionately greater with slower printers and less with faster ones.

Hardware and Installation

The MicroFazer uses a custom LSI chip and up to eight 64K bit RAM memory chips on a single board. It is possible to purchase the MicroFazer with just one chip installed (8K bytes) and then upgrade it with more memory later on. Quadram supplies versions of the MicroFazer with 8K, 16K, 32K, 48K, and 64K. You should choose a version with enough memory to handle the longest documents you normally write.

MicroFazer may be plugged directly into Centronics-compatible printers. You simply unplug the cable connected to the printer, plug the MicroFazer cable into the printer, and plug the computer cable into the MicroFazer.

If the printer you are using is not Centronics-compatible or does not use a G-520 36-pin connector, you will have to make or purchase modified cables. A block diagram of the MicroFazer including all connector pin designations is in the manual.

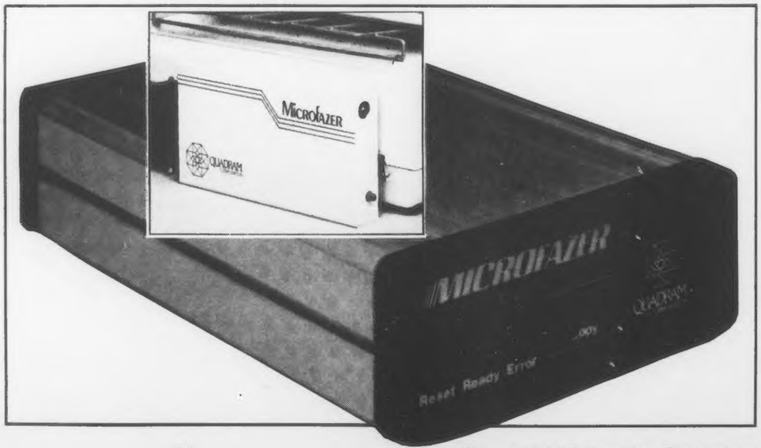
Power is supplied to the MicroFazer either directly from the printer or from an external 9v power supply. Some printers have power available on pin 18 while others, including the Epson series, do not.

The manual includes a simple modification which allows Epson MX series printers to get power for the MicroFazer. You must remove the bottom cover of the printer, remove the top printed circuit board, and run a jumper from one of the resistor pins to connector pin 18. It is a simple modification but, unfortunately, voids the Epson warranty. If you don't want to do this you can, of course, use the external supply.

An external power supply is not furnished by Quadram but one can be purchased in most electronic outlets for $5.00 or $6.00.

The MicroFazer comes in two case styles, free-standing and snap-on. The snap-on unit measures a compact 3.5" x 7" x 1" while the free-standing one is slightly larger, 5.5" x 8" x 2". The snap-on unit bolts to the back of the printer. It has just one external control, a reset button. It also has a red LED which indicates whether it is ready to receive data. An internal slide switch is used to choose between internal and external power.

The free-standing unit also has a reset button, ready indicator, and external power supply switch. In addition, it has an LED which indicates an error condition (cable not plugged in, printer not



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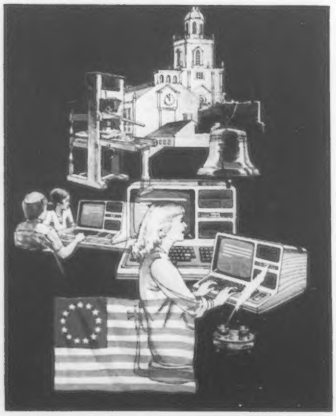

Teach the A-B-C's! *AlphaKey*™ (26-1718, $39.95) helps children 4 to 6 years old learn the alphabet and computer keyboard. Requires a 16K Level II or Model III BASIC TRS-80.

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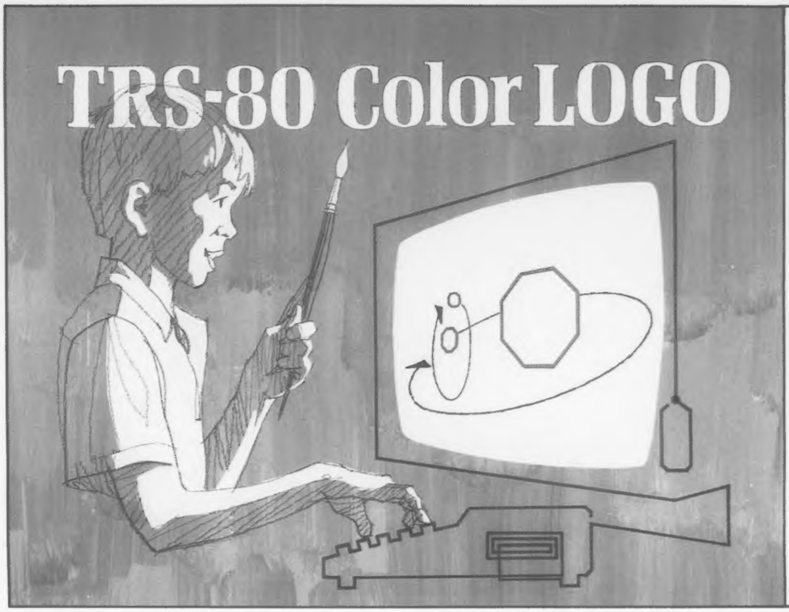
Radio Shack's High Motivation Reading Series (HMRS) is based on motivational reading materials for levels 4-6 using an illustrated format. Four student readers and a read-along audio tape accompany the program. The computer measures comprehension in several skill areas, such as understanding the main idea, sequence of events, details, and separating fact and opinion.

Spelling and vocabulary exercises based on words from the story are also included in Model III versions. These exercises are repeatable—each session randomly selects a new sequence of problems from a large pool of possible words. Program requires TRS-80 MicroPILOT™ (26-2718 for Model III; 26-2205 for Model I).

The *HMRS Student Records System* (26-2521, $29.95 for Model III; 26-2508, $24.95 for Model I) can be used with the packages listed below to keep a record of student activity scores on disk. With optional printer, score files can be printed.

Model III HMRS packages require a 32K TRS-80 Model III disk system. Titles are: *HMRS Charles Lindbergh/Amelia Earhart* (26-2513, $74.95), *HMRS The Hound of the Baskervilles* (26-2514, $69.95), *HMRS Dracula* (26-2515, $69.95), *HMRS Moby Dick* (26-2516, $69.95), *HMRS The Beatles* (26-2517, $69.95) and *HMRS 20,000 Leagues Under the Sea* (26-2518, $69.95). Model I HMRS packages require a 32K Model I lower-case disk system. Titles are: *HMRS Dracula* (26-2502, $59.95) and *HMRS Moby Dick* (26-2503, $59.95).

Radio Shack
HIGH MOTIVATION READING SERIES



Color LOGO

Our Color LOGO programming language is designed to help students grasp fundamental programming concepts. Through manipulation of "turtle" graphics, students learn to write simple programs. The computer becomes a friendly learning tool, and students gain insight into advanced concepts. Children under reading age can use a "doodle" mode to create graphics. A "hatch" mode creates multiple turtles that can run separate programs simultaneously. Our *Disk Color LOGO* (26-2721, $99) requires a 32K Extended BASIC Color Computer and disk drive. The *Program Pak™ Color LOGO* (26-2722, $49.95) requires a 16K TRS-80 Color Computer. Use your own color TV with either version.

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Our authoring systems make it simple to create quality courseware. No programming knowledge is required.

Color PILOT lets you mix text and graphics for attractive screens. It features a built-in line editor and easy one-letter commands. *Disk Color PILOT* (26-2710, $79.95) requires a 32K TRS-80 Color Computer disk system. *Tape Color PILOT* (26-2709, $59.95) requires a 16K TRS-80 Color Computer. Use your own TV with either.

TRS-80 MicroPILOT™ is a command-oriented language that lets you create your own courseware or adapt it from any suitable curriculum. *Model I TRS-80 MicroPILOT* (26-2205, $99.95) requires a 32K TRS-80 Model I disk system. *Model III TRS-80 MicroPILOT* (26-2718, $119.95) requires a 32K TRS-80 Model III disk system.

TRS-80 AUTHOR I (26-1727, $149.95) is a screen-oriented authoring system with full-screen editing, graphics and automatic score-keeping option. Sample lessons included. A 32K Model I or III disk system is required.

TRS-80 AUTHOR I Lesson Presentation Package (26-2707, $64.95) presents lessons that have been created using TRS-80 AUTHOR I. A sample lesson is included on diskette. (Not required if you have TRS-80 AUTHOR I). A 32K Model I or III disk system is required.

Quick Quiz: A Mini-Authoring System (26-1728, $39.95) makes it easy for teachers to create, store, and give multiple-choice tests using a TRS-80. It provides a pre-designed multiple-choice format for typing up to 40 questions with four answer choices per question. Scores can be printed or stored in a disk file for later review. A 32K TRS-80 Model I or III disk system is required.

Our Education Management Systems Make Your Tasks Easier

CHAMPS™ (26-2703, $149.95) lets you store and analyze football scouting information on your opponents' offense. Designed for high school and college levels, CHAMPS prints a variety of charts and statistical reports. You can get comprehensive answers to specific tendency questions in seconds. Includes ten CHAMPS Scouting Manuals. Ten *Additional Scouting Manuals* (26-2708, $39.95) are also available. Requires 48K Model I or III disk system and 132 column printer.

REKORD Planner is a record-keeping system you can personalize to fit your own needs! Use *REKORD Planner* to file student data, quickly locate and print out student and school information, even generate reports. A program and tutorial diskette plus sample formats are included. Choose from *Administrator's Version* (26-2725, $499), *Counselor's Version* (26-2726, $499) and *Special Programs Version* (26-2727, $499). A 48K TRS-80 Model III disk system is required.

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REKORD for TRS-80 Model III
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Radio Shack's Computer Education Series

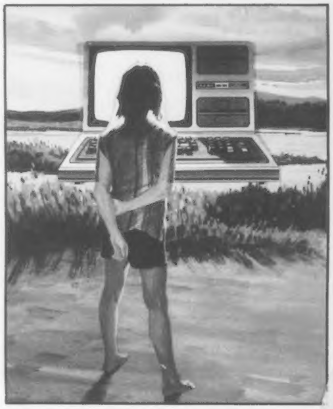
These *Courses in BASIC Programming* are complete classroom packages. Each package includes a set of overhead transparencies, a teacher's manual with instructions and answers, and 25 student workbooks. Each of the ten lessons has five parts—overview, objectives, note-taking guide, quick quiz and hands-on computer activity. Hands-on experience helps reinforce important programming concepts, principles and techniques.

Part 1: Introduction to BASIC (26-2150, $220) introduces students to the TRS-80 and BASIC language.
Additional Student Workbooks for Part 1 (26-2151, $3.50 each) are available.

Part 2: BASIC Programming (26-2152, $260) continues the concepts introduced in Part 1. Topics include arrays, memory management, string manipulation, and more.
Additional student Workbooks for Part 2 (26-2153, $4.50 each) are available.

Part 3: Advanced BASIC (26-2154, $260) introduces the INKEY$ statement, ASCII character set, action graphics, cassette data files, mathematic and trigonometric functions, and multi-dimensional arrays.
Additional Student Workbooks for Part 3 (26-2155, $4.50 each) are available.

NOTE: Software not included in the above series. Student activities are designed for hands-on experience with Level II or Model III BASIC.



Computer Discovery™ introduces computers, their evolution and impact on society, and basic programming concepts. Each includes interactive exercises, 25 workbooks, and instructor's manual.

Computer Discovery for Junior High (26-2630, $189.95) requires a disk-based 32K Model III. *Additional Workbooks* (26-2631, $4.25 each) are available.

Computer Discovery for Senior High (26-2632, $189.95 requires a 32K TRS-80 Model III disk system. *Additiona Workbooks* (26-2636, $4.25 each) are available.

MICHAEL P ZABINSKI

Our *Introduction to TRS-80 Level II BASIC* (26-2116, $9.95) is a unique textbook for use with secondary students. An excellent introduction to BASIC programming, it includes many programming examples. New concepts are introduced sequentially, with student exercises at the end of each chapter.

Computer Discovery is a trademark of SRA, Inc.

Radio Shack and TRS-80 are Number One in the Classroom

Radio Shack is the leading marketer of microcomputers to schools, with more TRS-80 computers in America's schools than any other brand. And we maintain an extensive development effort to produce instructionally sound, effective, and properly validated educational materials.

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Radio Shack gives you complete support. We have 24 Educational Coordinators located across the country. They can conduct demonstrations, workshops, and in-service training sessions for your school district. And they can assist you in selecting the computer system and courseware that best suits your needs. For more information, visit your nearest Radio Shack store, Computer Center or participating dealer. Or call your Educational Coordinator.

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We Offer a Complete K-8 Math Series —Including Extras That Save You Time!

Our *K-8 Math Series* is ideal for use as a supplement to regular classroom instruction in Kindergarten through eighth grades. This series has been designed by professional educators, and has been extensively field-tested in the classroom. Immediate feedback is given for correct and incorrect answers. Each program includes lesson summaries and a K-8 Math Cross-Reference to five of the most commonly-used math basals.

The *Radio Shack K-8 Math Program, Vol. I* (*26-1715, $199) provides randomly generated drill and practice problems in number concepts, addition, subtraction, multiplication and division. It features student placement, skill building and test modes, plus automatic promotion and demotion. A 16K Level II or Model III BASIC TRS-80 is required.

The *K-8 Math with Student Management, Vol. I* (*26-1725, $199) combines the K-8 program with a student management capability to monitor promotions and demotions, and allow for teacher review of scores. It also starts each student in the appropriate lesson each session. A 32K TRS-80 Model I or III disk system is required. Printer is optional.

The *K-8 Math Worksheet Generator* (26-2162, $99.95) prints worksheets and answer sheets from K-8 Math lessons. You can print multiple copies of identical worksheets or worksheets with different problems at the same difficulty level. Worksheets can be saved on disk for later use or editing. A 32K TRS-80 Model I or III disk system and TRS-80 line printer are required.

Advanced Programs for Secondary Math

Our *Essential Math Program, Vol. I and II* are drill and practice programs for grades 7-12. They are designed to reinforce math concepts introduced by the teacher. Both have been thoroughly field-tested. Each gives immediate feedback for correct and incorrect answers, and includes placement mode, and promotion and demotion. Both require a 16K Level II or Model III BASIC TRS-80.

Essential Math, Vol. I (*26-1716, $199) includes exercises in addition, subtraction, multiplication, division, and number concepts.

Essential Math, Vol. II (*26-1719, $199) covers fractions, decimals and percents, and pre-algebra concepts.

Euclid Geometry Tutor (*26-1724, $39.95) allows students to practice constructing proofs using nine basic postulates of Euclidean Geometry. It was developed by a high school geometry teacher and tested extensively in the classroom. The program consists of four modes: automatic mode completely illustrates a proof for the student; practice and quiz modes guide the student in constructing a proof; and a test mode monitors and checks a student's proof. Teacher's manual provides exercises covering a wide variety of problems. The program requires a 16K Level II or Model III BASIC TRS-80.

The following are additional Computer Assisted Instruction, simulation, problem-solving, or tutorial programs for the secondary student:

Advanced Graphics (*26-1714, $39.95) gives practice in analyzing equations, and plots graphs of functions and polar and parametric equations.

Vector Addition (*26-1720, $39.95) illustrates and plots components and sums of student-provided vectors.

Interpreting Graphs in Physics: Position and Velocity vs. Time (*26-1721, $39.95) poses graph-related questions in physics.

Graphical Analysis of Experimental Data (*26-1722, $39.95) plots data pairs that the student inputs.

Investigations in Integral Calculus (*26-2600, $39.95), graphs and computes areas of functions.

Plane Analytic Geometry (*26-2602, $39.95), generates problems with emphasis on straight lines as well as conic sections.

Number Theory (*26-2613, $69.95) includes definitions, examples, and exercises on number theory concepts.

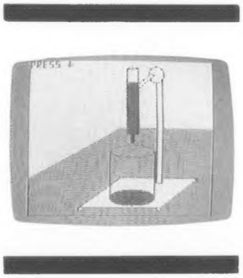
Matrices, Determinants, and Simultaneous Equations (*26-2620, $49.95) generates problems related to simple matrix algebra.

Quadratic Equations (*26-2623, $49.95) covers coefficient recognition, discriminate evaluation, type of roots, etc.

Each of the above programs requires a 16K Level II or Model III BASIC TRS-80.

Learning in an Electronic Chemistry Lab

The *TRS-80 Chemistry Lab* uses imaginative graphics and a series of mathematical equations to simulate chemical reactions that occur under actual laboratory conditions. Students control variables in experiments in order to see the changing results. Experiment topics include Kinetic Theory, Charles' Law, Boyle's Law, Titration, Conductivity and Solubility. Each package includes an instructor's manual and 25 student experiment books. The instructor's manual offers suggested areas for emphasis and methods of presentation. Student experiment books include topical background material on each experiment, instructions for using the programs, plus worksheets for use in summarizing experiment results.



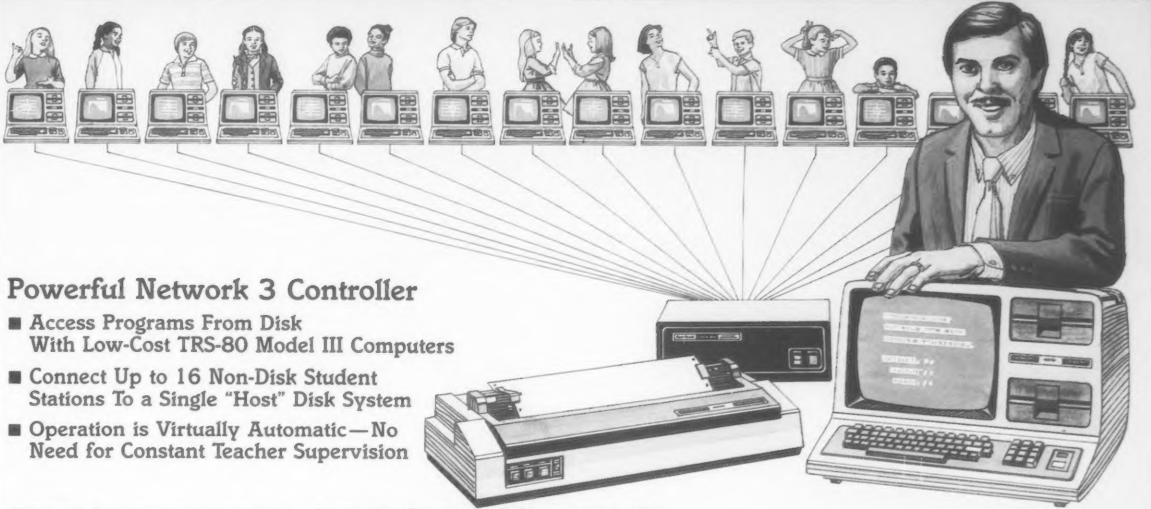
TRS-80 Chemistry Lab, Vol. I is available for the TRS-80 III/I (*26-2609, $199, 16K Level II or Model III BASIC) and for the TRS-80 Color Computer (26-2626, $199, 16K Color Computer and cassette player).

Additional Student Experiment Books (26-2666, $3 each) are available for the TRS-80 Chemistry Lab, Vol. I.

Sharpen Your Students' 10-Key Skills

Our *Numeric Data Entry Practice* (26-2601, $39.95) is a 25-lesson practice course to help students develop speed and accuracy in the 10-key entry of numeric data. Using the TRS-80 standard numeric keypad, students "key in" numbers, and the computer graphs and records performance. It's an ideal business education program. A 32K TRS-80 Model I or III disk system is required. Printer is optional.

**Network 3 compatible*



Powerful Network 3 Controller

- **Access Programs From Disk With Low-Cost TRS-80 Model III Computers**
- **Connect Up to 16 Non-Disk Student Stations To a Single "Host" Disk System**
- **Operation is Virtually Automatic—No Need for Constant Teacher Supervision**

Network 3 system requirements—Controller, Operating Software, and cables. Minimum student station: 16K Model III with Model III BASIC and RS-232C interface. Minimum host station: 32K 1-Disk Model III with RS-232C interface. Line printer optional.

The Versatile Network 3

The *Network 3 Controller* (26-1212, $599) enables educators to design a Shared Learning System of up to 16 non-disk Model III student stations connected to a disk-equipped "host" system. Student stations access the disk drives and printer of the teacher's host system, providing them with most of the same disk features that make a disk-equipped computer so powerful. A Network 3 Shared Learning System is not only highly cost-effective, but it eliminates the need for close supervision. And an optional line printer attached to the host system lets students get printouts without teacher assistance. Network 3 is designed for use with the educational software packages indicated in this catalog by an asterisk (*). Other business or application packages may not be suitable for use with Network 3.

Network 3 Operating Software (26-2775, $149) supports the Network 3 host and its student stations with many of the capabilities of TRSDOS and Disk BASIC. It permits student stations to SAVE and LOAD programs directly to and from the host disk, and LLIST and LPRINT to the host printer. Printer access requests are "spooled" at the host until the printer is free, so pupils can move on to the next project without delay.

Network 2 Saves You Time

Radio Shack's *Network 2 Controller* (26-1211, $499) lets teachers connect up to 16 non-disk student stations to a single "host" computer using the cassette ports. The teacher can up- and download programs to these student stations simultaneously. It requires a Model I or III host computer with disk drive and up to 16 Model I or III stations, or a Color Computer host with disk drive and up to 16 Color Computer stations. All cables are included.

Radio Shack Has a Complete Selection Of RS-232C Cables and Extenders

We have an assortment of cables and accessories for the Network 3 (or other RS-232C serial requirements). Our *Extended RS-232C Cables* allow great flexibility. Round cable lengths include: *10-ft.* (26-1490, $29.95), *25-ft.* (26-1491, $39.95), *50-ft.* (26-1492, $54.95) and *100-ft.* (26-1493, $89.95). The *RS-232C Cable Extender* (26-1495, $29.95) lets you customize cable lengths. The *Model III RS-232C Cable Extender* (26-1497, $17.95) allows use of round RS-232C cables with Model III.

Radio Shack Gives You a Variety of Helpful Educational Resource Materials

Our *TRS-80 Educational Software Sourcebook* (26-2756, $4.95) is a special edition of the TRS-80 Software Sourcebook. Vendor-furnished listings include descriptions of programs, plus user site references.

The *TRS-80 Microcomputer Information Handbook for Educators* (26-2757, $2.50) describes what microcomputers are and how they can be used in classrooms.

Radio Shack's Proposal Writing Guide (26-2754, $9.95) is a guide for educators seeking funding from an outside source for computer-related education projects.

Basic Computer Literacy: Computers Past and Present (26-2755, $9.95) illustrates the history of computers.

Careers in Computing (26-2758, $130) contains a filmstrip, spirit masters, 30 student manuals and more. Additional *Student Manuals* (26-2759, $1 each) are available.

My TRS-80 Likes Me (26-2751, $2.50) is a teacher's guide to helping elementary students understand and enjoy BASIC.

Number Patterns (26-2752, $2.50) shows how to introduce sequences and series in an enjoyable way using computers.

Microfazer, continued...

ready, etc.). A second pushbutton switch, labeled "Copy" is used to repeat the print operation with the data in the MicroFazer buffer. When this has been pressed, a red "Copy" LED is illuminated.

MicroFazer is available in three configurations, parallel in/parallel out, serial in/parallel out, and serial in/serial out.

If you are doing a really heavy volume of printing, two or more MicroFazers can be connected end to end to obtain increased buffering (128K, 192K, or more).

Another related product by Quadram is InterFazer which is described in the manual as "an intelligent controller/buffer that allows up to eight computers to be connected to one or two printers. Computers can be connected either through serial or parallel input ports and the printers can be serial or parallel. Inputs and outputs do not have to match."

Simple Operation

Once installed, the MicroFazer is invisible to the user. Upon powering up your system, you simply turn on the computer, printer, and MicroFazer. If everything is plugged into a switch-type power strip, one switch can bring up the whole system. The "ready" indicators on the printer and MicroFazer should both be on. If they are not, pressing the reset button on MicroFazer should bring everything to a ready state.

During printing, the MicroFazer reset button will clear the buffer and halt the print process.

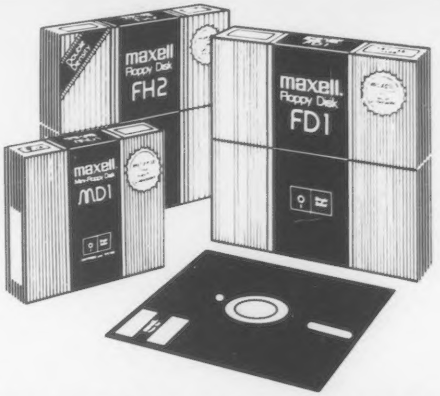
As long as the ready LED is illuminated, you can send data to the MicroFazer. For example, if you are printing a long document and finish editing a short one, you can send it to the MicroFazer and go on to something else. Just be sure the second document starts with a printer form feed.

Summary

The MicroFazer saves a significant amount of computer time when printing long documents. With a slow daisy wheel printer (40 cps and under), the computer will be tied up for printing less than 1% of the time it would be without the MicroFazer. With a medium speed printer (80 cps range), the time saving is about 1 to 46, while with a higher speed printer (200 cps) the saving is still a significant 1 to 20.

MicroFazer is easy to install on most printers with parallel Centronics-type connectors or serial DB-25 type connectors. In normal operation, MicroFazer is invisible to the user.

The price of a parallel/parallel 8K freestanding MicroFazer is $169; the snap-on unit is $10 less. Both 64K units cost the same, $299. MicroFazer is available in many computer stores or directly from the manufacturer, Quadram Corp., 4357 Park Dr., Norcross, GA 30093. (404) 923-6666. □



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CIRCLE 279 ON READER SERVICE CARD

Printer Update

Owen Linzmayer

Even as we checked the last typeface and measured the last decibel for the foregoing evaluations, new printers were being announced at fall Comdex in Las Vegas.

The capsule descriptions that follow were gleaned from press releases provided by manufacturers of some of the most significant printers introduced.

For more information, circle the indicated Reader Service numbers and watch these pages for in-depth evaluations in future issues.

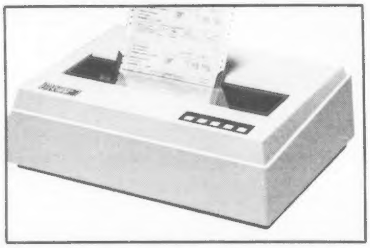
Anadex DP-9625A

Anadex has introduced their newest dual-pass dot-matrix printer, the DP-9625A. This printer has a speed range of 50-200 cps, depending on the letter quality mode selected. The DP-9625A is capable of hi-res graphics with up to 144 dpi. Anadex claims a noise level of 55 dBA. The DP-9625A has parallel and serial interfaces standard. Anadex, 9825 De Soto Ave., Chatsworth, CA 91311. (213) 998-8010.

CIRCLE 413 ON READER SERVICE CARD

Hi-G Durawriters

Hi-G is manufacturing a new line of high performance dot-matrix printers designed for heavy-duty business use. The three printers are essentially the same with different width columns (132, 80, and 80 for continuous form printing). The Durawriters check in at around 150 cps at less than 60 dBA. Each is bi-directional, logic-seeking and has a 3422-character buffer. These printers come with Centronics compatible parallel, RS-232C serial, or current loop interfaces. Hi-G Inc., 580 Spring St., Windsor Locks, CT 06096. (203) 623-2481.



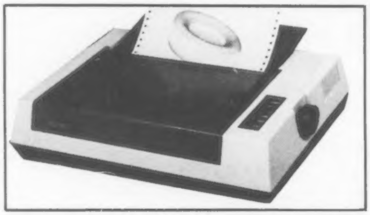
CIRCLE 414 ON READER SERVICE CARD

Transtar 130 and 315

At Comdex, Transtar unveiled two new printers. The Transtar 130 is a letter quality printer compatible with all word processing software using Diablo routines.

The 130 has a standard 2K buffer, and 16 cps bi-directional printing, and can be ordered with either parallel or serial interfacing.

The Transtar 315 four-color printer has a price of $599. Over 30 possible shades of color can be printed with one pass due to a unique four hammer printhead. Transtar offers an Apple II interface option, PICS, which allows for easy screen dumps. Transtar, Box C-96975, Bellevue, WA 98009. (206) 454-9250.



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Trilog TIP-150

This printer has a top speed of 150 lines per minute. The TIP-150 can print up to 16.6 cpi on 3" to 16" fan-fold paper.

The TIP-150 is an intelligent printer which employs dot-matrix impact printing and provides built-in graphics plotting capabilities. It is field upgradeable to the TIP-

NEC's new letter-quality printer gets personal with IBM.

The Spinwriter™3550 lets the IBM PC get down to business.
NEC's new Spinwriter letter-quality printer is the *only* one plug-compatible with the IBM Personal Computer. So you get the business applications you've been wishing for. Letter-quality output for word and data processing. Multi-language, scientific, and technical printing. Simple forms handling. Quiet operation. And the reliability of the industry's most popular printer line.

NEC designed the new Spinwriter especially for the IBM PC. It comes complete with documentation and training materials to fit your PC user's handbook. Just plug the Spinwriter in and your PC instantly becomes more versatile and flexible.

More than 8 forms handlers and 50 print thimbles boost PC versatility.
NEC designed the Spinwriter's 8 modular forms handlers to accommodate a wide range of paper and document sizes and types. The easily mounted handlers let your computer print out the forms you need for data processing, word processing, graphics, accounting or other business applications.

The Spinwriter's 50 print thimbles can more than triple your PC's usefulness. They come in both constant pitch and proportional-spaced fonts, plus in foreign language, technical and scientific versions. They snap in and out in seconds, and let you print up to 203 columns on 16-inch paper. They each last for more than 30 million impressions.

This printer's special features make everything look better on paper.
The Spinwriter's software-invoked features include automatic proportional spacing; bidirectional, bold and shadow printing; justification; centering; underscoring; and sub/super scripting, all at speeds up to 350 words per minute.

That big extra, Spinwriter reliability.
Spinwriters have the industry's best mean-time-between-failure rating, in excess of 3,000 hours. In terms of average personal computer usage, that's more than five years.

The Spinwriter 3550 is available at **ComputerLand** stores, **Sears Business Systems Centers** and **IBM Product Centers** nationwide.

NEC Information Systems, Inc.
5 Militia Drive, Lexington, MA 02173

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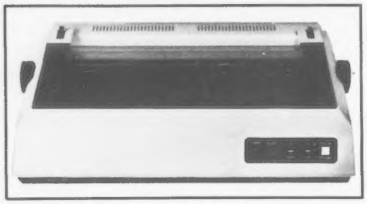
300, which has a speed of 300 lines per minute. Trilog Inc., 17391 Murphy Ave., Irvine, CA 92714. (714) 549-4079.

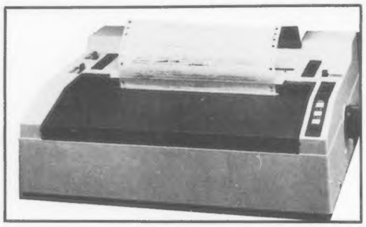
CIRCLE 416 ON READER SERVICE CARD

C. Itoh A-10 Daisy Wheel and 8600 Impact

The A-10 is a complement to earlier C. Itoh printers, with a 10-character wheel and a print speed of 18 cps. A-10 options include serial or parallel interfaces and friction- or tractor-feed.



The 8600 is a variable speed printer with an 18-wire head. It can handle hi-res graphics, letter quality, and data processing (180 cps). The printer has a 9 x 9 matrix and an 80-column format. The 8600 is bi-directional, and has a 2K expandable buffer and standard parallel and serial interfacing. C. Itoh Electronics, 5301 Beethoven St., Los Angeles, CA 90066. (213) 306-6700.



CIRCLE 417 ON READER SERVICE CARD

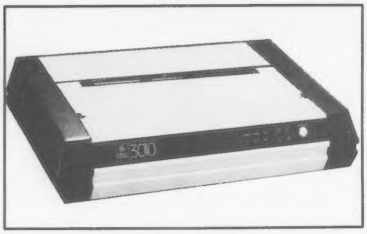
Data Impact D-82 F/T

Data Impact, a Boston firm introduces a low-cost dot-matrix printer with selectable tractor or friction feed. A 7 x 7 matrix, 100 cps bi-directional print speed, and 800-character buffer are some of the features of the $599 D-82 F/T printer. Data Impact Products, 745 Atlantic Ave., Boston, MA 02111. (617) 492-4214.

CIRCLE 418 ON READER SERVICE CARD

GE 3010

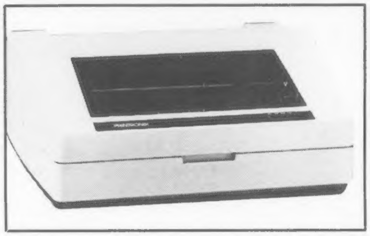
Expanding their 3000 line of printers, GE offers its new creation, the GE 3010 dot-matrix printer with dot-addressable graphics. The 3010 can print up to four copies bi-directionally at 160 cps. The 3010 has a 2K standard buffer and employs a printhead capable of continuous underscoring and descenders. The 3010 uses a four-pin tractor, handles paper ranging from 3" to 15.5" and has a print density which can be set at a maximum of 16.5 cpi. General Electric Data Communications, Waynesboro, VA 22980. (703) 949-1170.



CIRCLE 419 ON READER SERVICE CARD

Printronix MVP

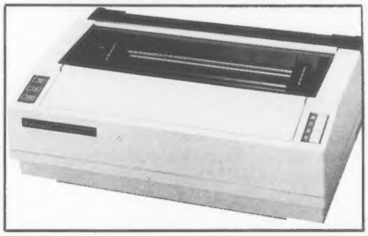
The MVP is the newest matrix impact line printer available from Printronix. The MVP is styled for office use and can print up to 200 lines per minute, and plot a maximum of 27.9 inches per minute. The MVP carries a price tag of $3745. Printronix, 17500 Cartwright Rd., Box 19559, Irvine, CA 92713. (714) 549-7700.



CIRCLE 420 ON READER SERVICE CARD

Panasonic KX-P1160 and KX-P1090

Two dot-matrix impact printers featuring hi-speed printing and graph capabilities have been introduced by Panasonic. The KX-P1160 is a bidirectional 16-pin printer with a logic seeking head designed to print up to 196 cps. The 9 x 13 matrix forms 96 ASCII characters with descenders. This unit has an adjustable sprocket pin feed capable of handling fan-fold paper from 4" to 15" in width and sells for $1550.



The model KX-P1090 features an endless and seamless cartridge ribbon. It is a bi-directional 9-pin printer which can print 96 cps and 80 characters per line. The KX-P1090 accepts paper 4" to 10" in width. With the standard parallel interface, the KX-P1090 printer costs $650. Panasonic, 1 Panasonic Way, Secaucus, NJ 07094. (201) 348-5337.

CIRCLE 421 ON READER SERVICE CARD

Facit/Dataroyal IPS-5000-V

Expanding its IPS-5000 family of intelligent printers, Facit/Dataroyal has introduced the IPS-5000-V, a 165 cps unit that prints text, pin graphics (72 x 120 resolution), variable-sized matrix characters, nine bar codes, and labels for shipping and other applications. The IPS-5000-V comes with a parallel interface and a standard 2K character buffer. Facit/Dataroyal,235 Main Dunstable Rd., Box 828, Nashua, NH 03061.

CIRCLE 422 ON READER SERVICE CARD

MPI Printmate 99

This 100 cps unit comes with a 1K buffer (expandable to 2K) and is equipped for both parallel and serial interface. Near letter-quality printing is possible with an 11 x 9 dot matrix font. Friction and tractor-feed are user selectable. Paper can be loaded from the front, bottom, or rear of the unit. Hi-res, dot addressable graphics capabilities are standard. Micro Peripherals, Inc., 4426 South Century Dr., Salt Lake City, UT 84107. (800) 821-8848.

CIRCLE 423 ON READER SERVICE CARD

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Both of our new high performers have no duty cycle limitations and feature the Okidata, 9-pin print head that's guaranteed for one full year. But the really great news about each is price: $699 suggested retail for the ML 92; $1249 for its big brother. Absolutely purrrfect.

For more great news about the ML 92, 93 and all the Okidata printers, see your computer dealer or call 1-800-OKIDATA. In NJ, 609-235-2600. Okidata, Mt. Laurel, NJ 08054.

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THE SUPERPLOTTER ©

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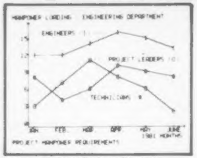
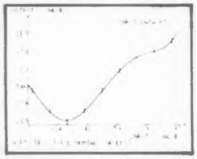
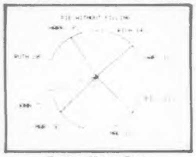
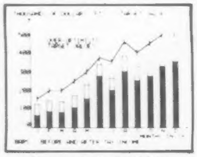

General Purpose Plotting


Statistical Data Analysis Forecasting Tool


Decision Making Tool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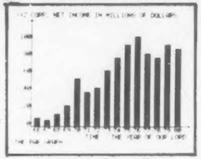
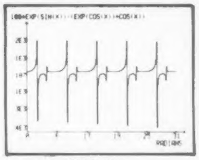
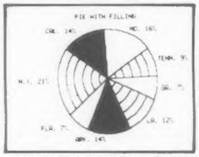

Visual Aid for Presentations


Plot Anything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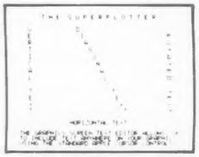
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COTTAGE SOFTWARE
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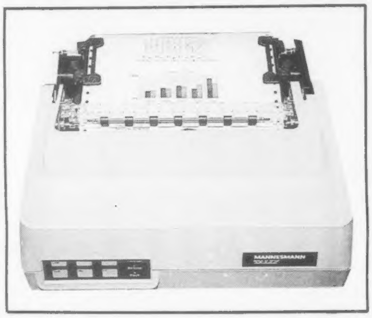
CIRCLE 152 ON READER SERVICE CARD

Printer Update, continued...

Mannesmann Tally MT 160

Designed for professionals in business, science, and industry, the MT 160 offers a print speed of 160 cps, bi-directional printing, logic seeking, eight letter widths, full graphics capability, and dual interface ports. Mannesmann Tally, 8301 South 180th St., Kent, WA 98032. (206) 251-5500.



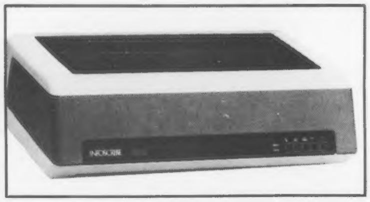
CIRCLE 424 ON READER SERVICE CARD

Infoscribe 1200 and 1500

The 1200 is Infoscribe's first multicolor (8) dot-matrix printer. This unit prints up to 200 cps, and dot density can go as high as a 19 x 18 matrix. In the dot-addressable color graphics mode, the printer resolution is 72 x 72 dpi. The 1200 costs $2495 and has a six month warranty.

INFOSCRIBE

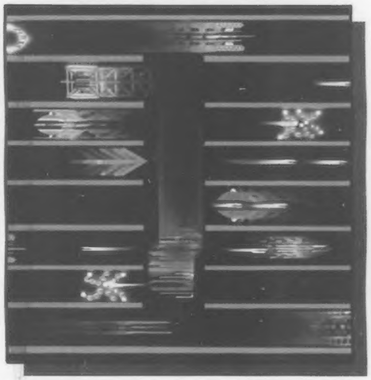
The Infoscribe 1500 is a high speed dot-matrix printer offering up to 400 cps. The 1500 printhead has a double set of wires (18 wires total) which allows for high speed output. Dot addressable graphics (72 x 72 dpsi) are available. The 1500 handles superscripts, subscripts, and underlining. It has a 3500-character input buffer, resident and downloadable character sets, and an integral self-test. Infoscribe, 2720 South Croddy Way, Santa Ana, CA 92704. (714) 641-8595. ☐



CIRCLE 425 ON READER SERVICE CARD

New From Sirius™
For The Big Game Hunter

TURMOIL™



You're being attacked from both sides by the most evil aliens to ever fly the unfriendly skies. Luckily, your intergalactic fighter can blast seven enemies into cosmic dust at once. Trouble is, those aliens are very fast. If you can turn the lights off and be in bed before the room gets dark, then you might be ready for Turmoil.

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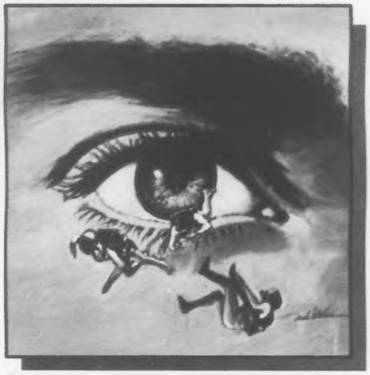

An incredible medical journey is about to begin. You and your submarine are to be reduced to microscopic proportions and injected into the blood stream of a critically ill patient. You must navigate past deadly Defense Cells, Bacteria, Antibodies and Enzymes to destroy a life-threatening blood clot near each patient's brain. Prepare yourself for one Fantastic Voyage!

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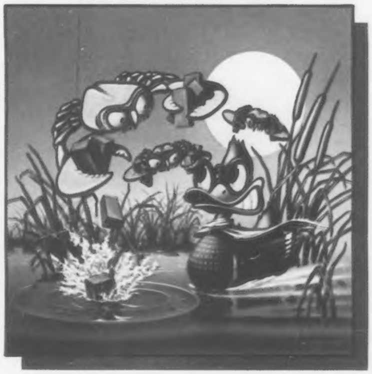
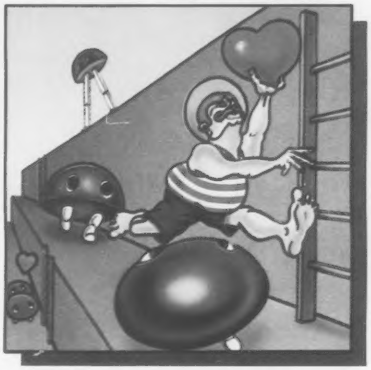


Those cranky crabs are trying to drive the ducks from their once quiet pond. Imagine, crabs taking to the air armed with bricks and bombs! Luckily, Deadly Duck has a few tricks of his own. His gun barrel bill can unleash a bevy of crab cracking bullets at a moment's notice. Look out, Deadly, here comes another brick! It takes more than luck to play Deadly Duck.

Fast Eddie™



You've got to be cool and you've got to be steady to play Fast Eddie. Eddie is on a wild treasure hunt, climbing up and down ladders everywhere in search of prizes. Things would sure be a lot easier if it weren't for all of those pesky little Sneakers™ running around. They literally keep him jumping!

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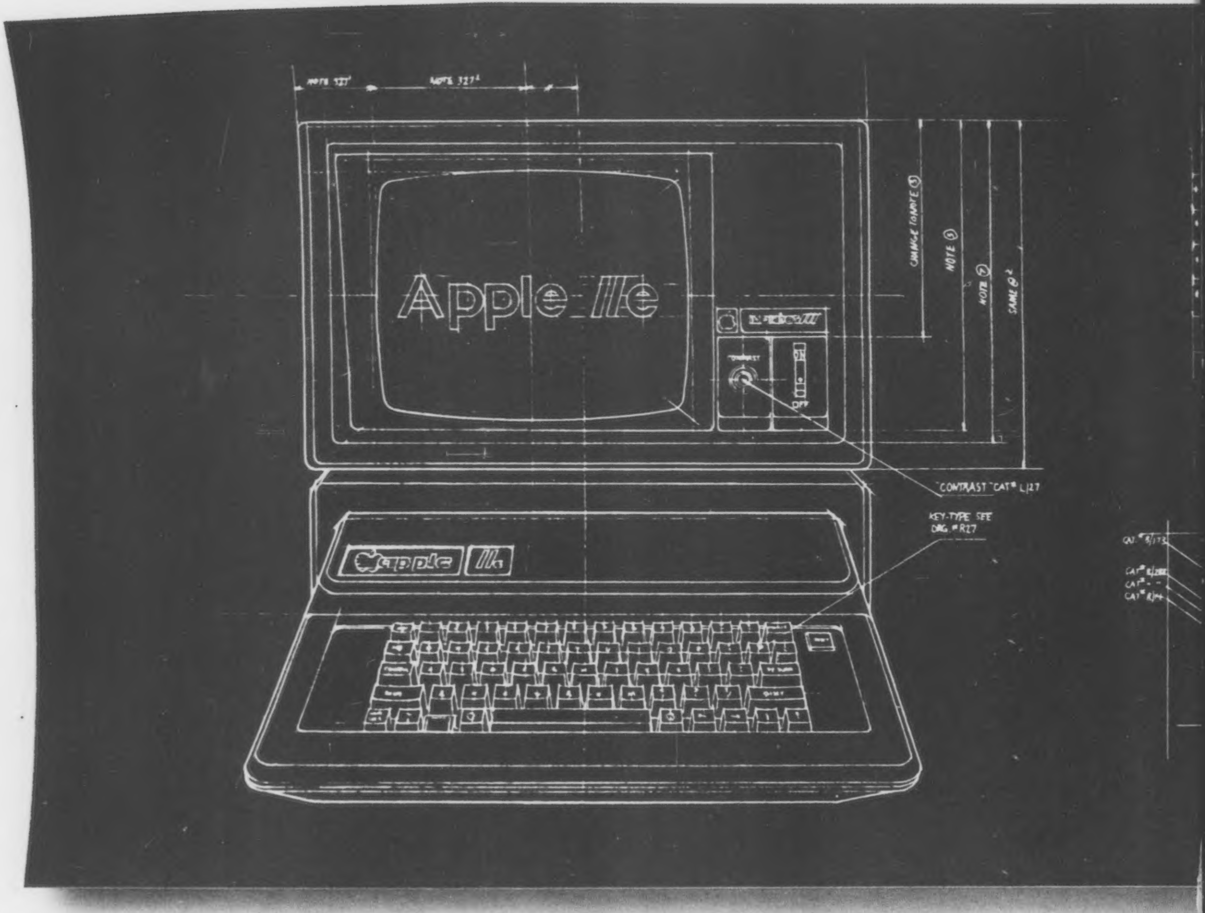
CIRCLE 268 ON READER SERVICE CARD

It's the same old Apple II.



NOTE 327
NOTE 327
Apple IIe
CHANGE TO NOTE ⑤
NOTE ⑤
NOTE ⑦
SAME @2
CONTRAST
ON
OFF
CONTRAST CAT# L/27
KEY-TYPE SEE DRG. #R27
apple IIe
CAT# 3/173
CAT# R/288
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Improved peripheral ports. Which make it a lot easier to connect and disconnect game controllers, printers and all those other wonderful things that go with an Apple Personal Computer.

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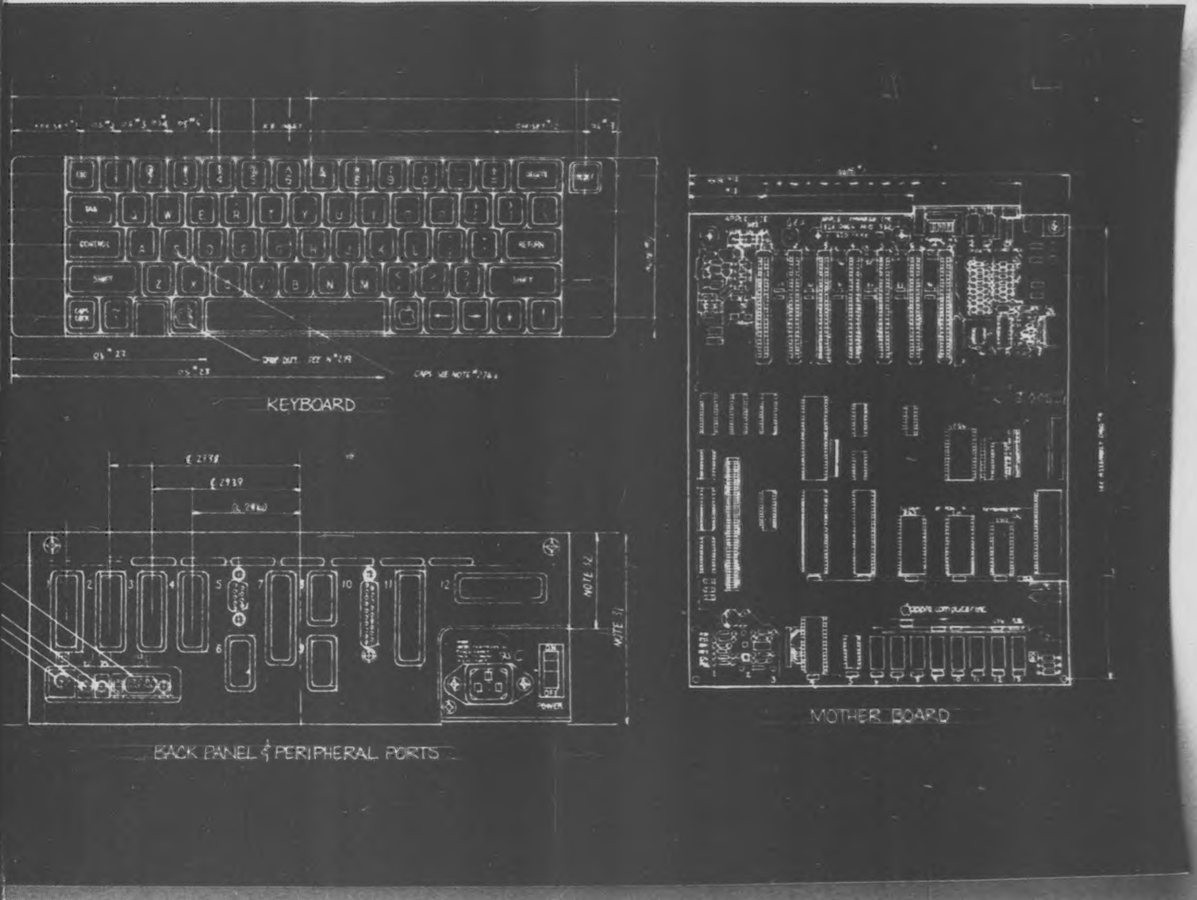

Self-diagnostics. That's a special feature that makes it easy to give your computer a thorough check-up.

Plus an even more reliable design. Achieved by reducing the number of components—which is to say, the number of things that could go wrong.

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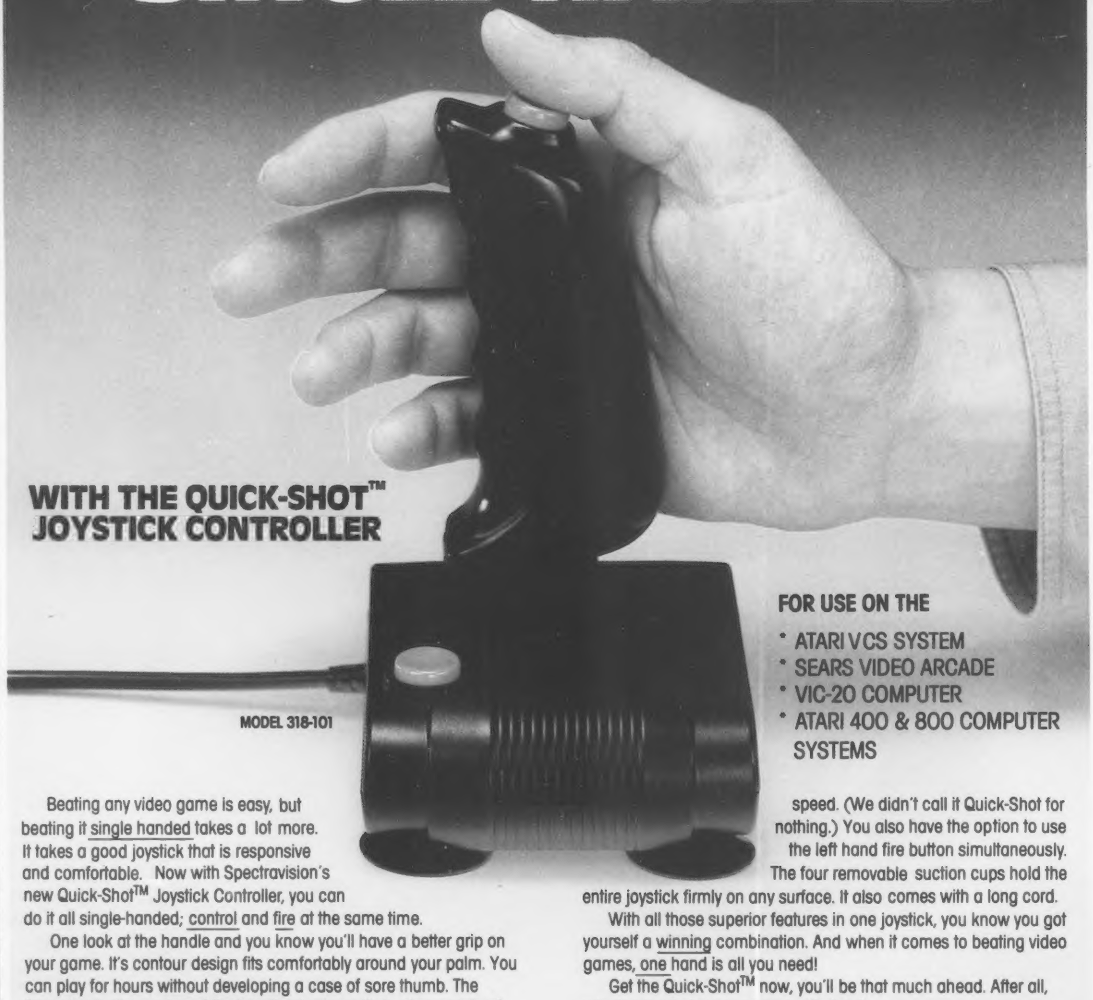
HOW TO BEAT ANY VIDEO GAME SINGLE-HANDED.



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CIRCLE 262 ON READER SERVICE CARD

creative
computing
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evaluation

Word Processing On The Apple With WordStar and Diablo

Jerry Mar

When you use your Apple for word processing, do you find you are becoming increasingly frustrated by the limitations of your "simple" 40-column Apple word processing program? If so, at one time or another you have probably considered upgrading your Apple for serious word processing—specifically, by adding an 80-column card, a letter quality printer, and a professional word processing program.

This is exactly what I went through. At the time, I had been using Apple Computer's *Applewriter* program, Dan Paymar's lower case adapter and a Trendcom 200 printer for my word processing. Despite the many limitations of that combination (40-column display, words split across lines, and hard to read thermal paper outputs), I found I was using my Apple for word processing more and more often. In fact, word processing had become the main application for my Apple, exceeding even *VisiCalc*. I found my use of it for composing draft–copies of reports, memoranda, and letters saved me time and improved my writing. The ease with which text could be altered and modified on the computer made it easy for me to experiment with words—far easier than if I had used pencil and paper.

These gains in personal productivity spurred me to think how much greater my productivity would be with a professional word processing system. It was at that time I decided to turn my Apple into a "professional quality" word processing system.

I decided my upgraded system would consist of a Diablo 630 printer, a Videx Videoterm 80-column display, and MicroPro's *WordStar* word processing program.

I chose the Diablo 630 because of its flexibility in handling both plastic and metal daisy wheel print wheels, and because it was the most established (i.e., been on the market for the longest time) of the second generation daisy wheel printers (lower cost printers using more electronics and fewer mechanics). I chose the Videx 80-column card because of its relatively cool operation (it uses low power CMOS integrated circuits), its use of a 7 x 9 character matrix (its characters seem more readable than the other cards I had looked at), and because (at the time of my purchase) it was one of two 80-column cards directly supported in the installation procedures included with *WordStar*.

Although *WordStar* requires a Z80 SoftCard to be added to the Apple (to enable it to run CP/M programs), I chose it because of its reputation as the Cadillac of microcomputer word processing programs and because the final printout format (including page

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Jerry Mar, 1495 Chukar Court, Sunnyvale, CA 94087.

breaks) is continuously visible as text is entered.

Many of you may be considering such an upgrade, so let me describe what I went through to make it work. Let me say at the outset that my final system works very well, but getting there was anything but straightforward. In making such a combination work, one is faced with making five semi-independent computer systems (the Apple 6502, the SoftCard Z80, the controller on the Apple printer serial interface card, the keyboard/character processor in the 80-column card, and the 8085 microprocessor in the printer) work together. The whole process took several months of effort. I took many blind paths, made lots of mistakes, and spent more money than I needed to. Fortunately, you can learn from my experience and avoid my pitfalls.

My final system works very well, but getting there was anything but straightforward.

What Not To Do

Because of my existing *Applewriter* text files and the considerable expense of the upgrade, I decided to do the upgrade in several stages. Since the most limiting feature of the *Applewriter*/Trendcom combination was its inability to generate letter quality reports, the first stage of my upgrade was to add a Diablo 630 daisy wheel printer to use with my existing *Applewriter* program. As you will later see, this was a mistake.

An RS-232C serial interface is needed to connect such printers to the Apple. Following the recommendations in my *Applewriter* manual, I purchased the Apple High Speed Serial Card for this purpose.

Now it turns out that Diablo 630 receive-only printers (printers without a typewriter keyboard) come in three versions. There is the bottom of the line version (Model R110, also called the OEM model) with a minimal three-button control panel. There is the middle version (Model R102, often referred to as the standard model) with a seven-button control panel and a full complement of warning indicators. Finally, there is the full-featured version (Model R104, which is the standard version upgraded with the W/P or Communications Option) with an eight-button control panel, built-in word processing commands and non-volatile memory (settings are retained even after power is shut off).

After some experimentation, I found my Apple/*Applewriter*/High Speed Serial Card combination would operate properly only with the full-featured Model R104 Diablo 630. Thinking that extra features would ensure compatibility with later word processing upgrades, I chose the R104 Diablo 630. With *Applewriter*, this combination worked superbly—however, as you will later see, it did not work well with *WordStar*.

I completed my upgrade when MicroPro released version 3.0 of *WordStar* for the Apple. In addition to buying that version of *WordStar*, I purchased the Videx 80-column card and the MicroSoft Z80 SoftCard. Since my old 9" Sanyo monitor was barely up to resolving 80 columns of characters, I also ended up purchasing a 12" NEC green screen monitor. Because *WordStar* (and most CP/M programs) are designed to be used with two-drive systems, I also added a second disk drive to my system.

Eager to make use of my new word processing capability, I proceeded directly to the installation of the program on my system. In *WordStar* this is done by running a special program called INSTALL.COM, which presents a menu-driven series of questions to the user. The selections chosen by the user configure the interface of the program to the hardware. Everything went smoothly until I reached the section on installing the printer.

In version 3.0 of *WordStar*, the Printer Selection menu includes a line for the Diablo 630. After I had selected that line, a message appeared telling me to select the ETX/ACK protocol in the next menu. The next installation menu was entitled Communications Protocol, and sure enough one of its selections was called ETX/ACK protocol. Obediently, I made that choice.

This menu was followed by the Driver menu which included such cryptic selections as CP/M List Device (LST:), CP/M primary Console Device (TTY:), Port Driver (direct I/O to 8-bit ports), and User-installed driver subroutines. After several readings of the manual I concluded that Port Driver was the correct choice, hoping that I was finished with this multiple-choice game.

My hopes were dashed when the program presented the first of the Port Driver selections: I/O and Memory Mapped. Rushing back to the *WordStar* manual, I looked in vain for some clue as to the correct selection. Finding none there, I searched for a hint in my Apple manuals. Somewhat hesitantly, I concluded that Memory Mapped was the correct choice.

That choice led immediately to the following series of questions: What is the Output address in hex? What is the Output Status address in hex? What is the Input address in hex? and What is the Input Status address in hex? These were followed by: What are the Output Port Bits for your printer? and What are the Input Status Port Bits for your printer? At this point I knew I was licked and immediately sought help. In an escalating fashion, I went to my dealer, Diablo customer service, and MicroPro customer service.

I'll spare you the gory details. Let me just say that I got *different* solutions from each source, and that none of the solutions using the Port Driver selection worked. On reporting my lack of success, the majority of my sources told me that I should then specify: the Teletype-like selection in the Printer Menu, None Required selection in the Protocol Menu, and CP/M list device (LST:) selection in the Driver Menu. However, they warned me that this arrangement did not allow handshaking (i.e., would not allow the printer and computer to communicate both ways) so that I would not be able to send characters to my printer at rates greater than 300 baud.

The last arrangement did work, and worked at 1200 baud. However, desirable word processing print features like bold-face and micro-justification (the *WordStar* approximation of proportional spacing) could not be used with that selection. I found these features were usable when the Diablo 630 selection was chosen in place of Teletype in the Printer Menu, however this installation had one problem.

The first stage of my upgrade was to add a Diablo 630 daisy wheel printer to use with my existing Applewriter program. This was a mistake.

With this installation, the program would not print properly in the single-page mode (this is where the printer stops after each page so that a new sheet of paper can be inserted.) The first page would print out perfectly, but after the paper change, succeeding pages were printed without any left margin. This happened at both 300 baud and 1200 baud.

After many more phone calls I was told that I should use California Computing's CCS7710A interface card instead of the Apple High Speed Serial Card. I tried that card and found I had

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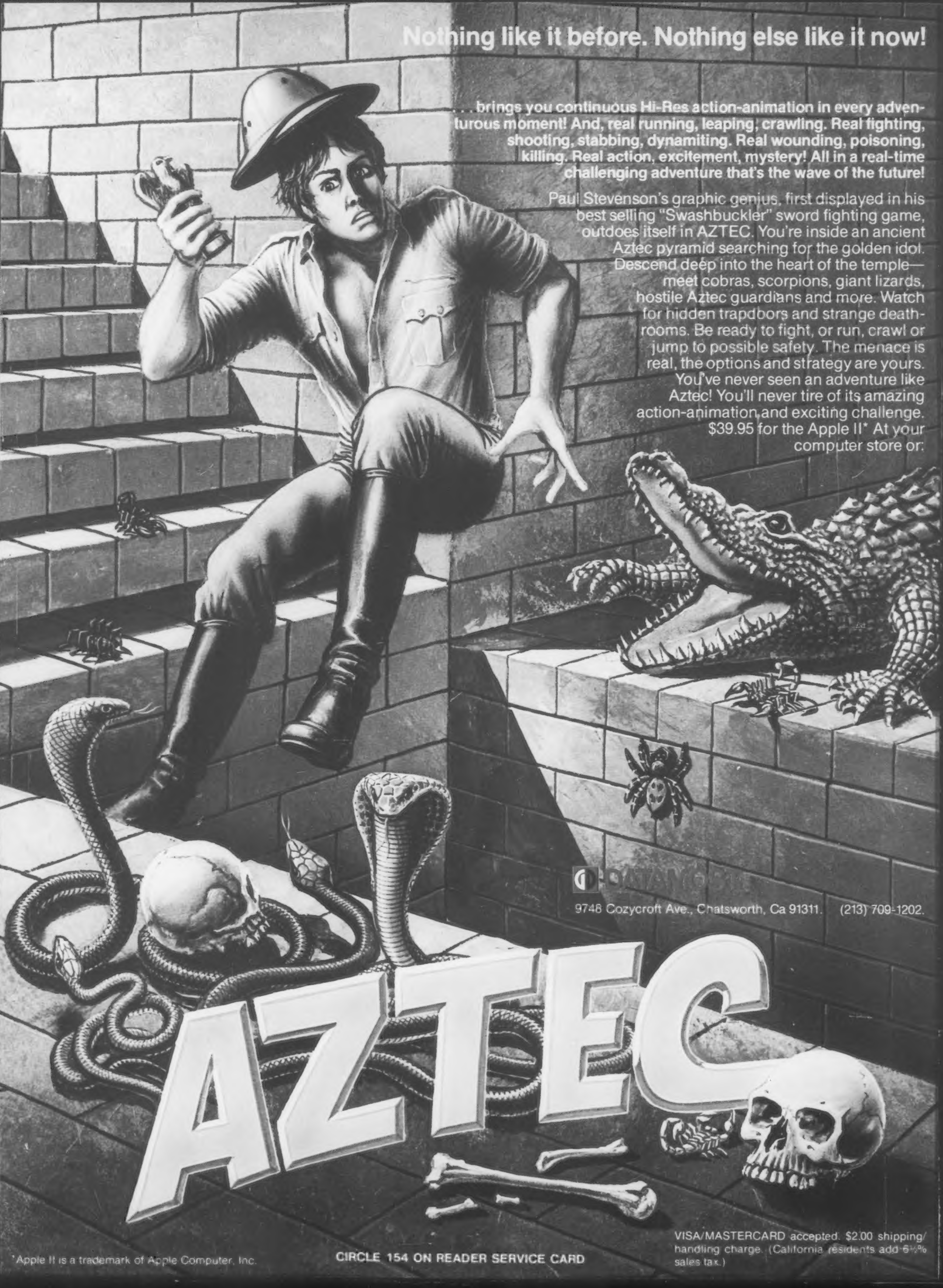

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exactly the same problem, except this time I did run into problems when printing at 1200 baud. It appears that the Apple Serial Card pauses after groups of characters are transmitted. This slows data transmission sufficiently to enable the printer to keep up with the data. With the CCS7710A card, characters are transmitted in a more continuous stream and the printer is unable to keep up with the data.

The main problem turned out to be the printer. When I used a standard (Model R102) Diablo 630 in place of the full-featured Model R104, the single-page problem disappeared. Thus my error was in buying the printer to run *Applewriter* first, since the combination needed to operate *WordStar* was different. None of my information sources, including people at Diablo, had suggested that this could cause problems.

The one other modification I would recommend for your Apple is the addition of a cooling fan.

What To Do

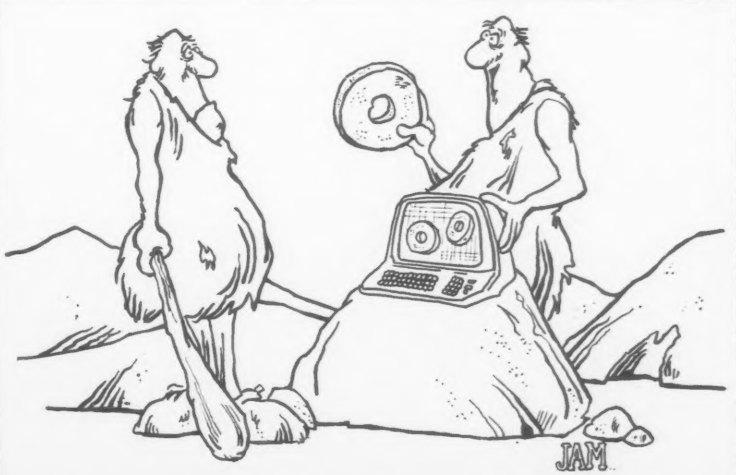
Having described what didn't work, let me tell you what did. As I indicated in the last section, the standard version Diablo 630 printer worked for me. As for a serial interface card, the CCS7710A card worked best. *WordStar* printing was significantly faster with the CCS7710A card than with the Apple High Speed card, however additional connector rewiring (described below) is needed to use it. The Videx 80-column card worked fine, especially after I made the shift-key modification (connecting a wire from the shift key to pin 4 of the game connector).

In order to use the CCS7710A card at 1200 baud, it must be made to handshake with the printer. To do this, the following changes must be made. Pins 4 and 20 must be crossed (not shorted) on the printer cable, so that connector-pin 20 on the CCS7710A card goes to connector pin 4 of the Diablo and connector pin 20 on the CCS7710A to connector pin 4 of the Diablo. This can be done by rewiring one of the connectors on the cables (not the card or the printer).

In addition, pins 5 and 6 on the internal "A60" jumper-block inside the Diablo printer must be shorted. This jumper-block is located on the top edge of the HPRO5 card inside the printer. To get at this block you must first remove the outer case and the internal shield cage surrounding the card. If you have difficulties with these changes, have your dealer do them for you.

Before beginning the installation of *WordStar*, you should use your CP/M utility disk to rename the *WordStar* file WSU.COM to WS.COM. If you do the renaming after installation (as suggested in the installation instructions I received with my copy of *WordStar*) you will not be able to run a program from the No-File Menu, which means you will not be able to check the amount of empty disk space while in *WordStar*.

As for the *WordStar* printer installation, the following worked for me. In the Printer Menu, choose Diablo 1610/1620 instead of Diablo 630. If the Diablo 630 selection works for you, you can also use that. However, when I selected that in my version of the program I lost the last line (usually the page number) when printing in the single-page mode. In the Communications Protocol Menu, select None required, and in the Driver Menu, select CP/M List device (LST:).



I've already programmed it on the CAD/CAM...so theoretically it should roll.

This should make your Apple a functioning *WordStar* system. However, since *WordStar* makes multiple uses of many of the standard keyboard keys (via CTRL key combinations), I have found labeling the keys to be very helpful. *WordStar* comes with stick-on key labels.

The one other modification I would recommend for your Apple is the addition of a cooling fan. The addition of the 80-column card and the Z80 SoftCard increases the power dissipation in the Apple enough to raise the internal temperature significantly. Perhaps it was merely a coincidence, but within a few months after my *WordStar* upgrade I had two separate incidents of component failure before adding a fan (the only failure in two years) and none since adding a fan. Based on an approximate measurement of internal temperatures, the fan reduced the inside case temperature from approximately 100° F to 80° F.

How Well Does It Work And Was It Worth It?

With the combination described above, *WordStar* operates very competently on the Apple II. All of the *WordStar* features (such as underlining, microjustification, boldface, and tabbing) are usable. The ability to see exactly how my text will be printed as I enter it has been exceedingly useful. I can easily tailor my text and tables for the best appearance on a page. The productivity improvements I had hoped for with this upgrade were fully realized. Both the speed of my writing and the appearance of my final documents have improved greatly.

Both the speed of my writing and the appearance of my final documents have improved greatly.

However, the system is by no means perfect. There are several annoying features, most of them related to the limitations of the Apple keyboard. For one, symbols like square and curly brackets are missing, as is a tab key. The lack of programmable function keys is also a negative. Such keys would have been useful for simplifying frequently used multiple-keystroke commands.

A particularly annoying feature is the delay between commands and screen response. Cursor moves in response to tabbing seem to take an inordinate amount of time. As a result, when moving across multiple tabs, it is extremely easy to overshoot the desired position. Likewise, when deleting by continuous backspacing (using the REPT key), the cursor continues to delete characters several seconds after the finger is removed from the backspace key. The column and line numbers also have trouble keeping up with autorepeating movements.

The autorepeating function often requires three keys to be depressed simultaneously (e.g., CTRL, E and REPT keys must be held down at the same time to move the cursor up continuously, an operation that can be done on some computer systems with one key).

One last keyboard annoyance related to the use of the ESC key is the upper/lower-case shift-lock (at least when using the shift-key mod). Since many of the *WordStar* commands also end with a depression of the ESC key, inadvertent shifts often occur which must be unlocked with an extra depression of the key. Some of the above keyboard deficiencies can probably be corrected by adding the Videx Keyboard Enhancer, but I did not try that combination.

The other area that could have been nicer is the video display. Screen scrolling, particularly downward scrolling, occurs jerkily (the screen updates long after the key is depressed). This seems to be a result of the relatively long time needed to rewrite the screen (close to three seconds when scrolling downward). Screen highlighting is also not available with the hardware combination. Had this feature been available, the *WordStar* display on the Apple would have been easier to read—especially when mixing soft and hard hyphens, and performing block operations.

On the plus side, despite the lack of special keys, the crisp action of the Apple keyboard makes it quite comfortable to use for word processing. In addition, what keys there are are placed in logical locations (more so than in several other computers with more keys). Although the video display lacks features, it is very clear and easy to read. As a consequence, one can learn to live quite comfortably with the above deficiencies.

An important word processing plus is the fast printing when using the CCS7710A card. With this card, *WordStar* prints faster on the Apple than it does on many other CP/M computer systems using the Diablo 630.

An added bonus from the upgrade was the enhancement of the other applications of my Apple system. Basic-80, supplied with the Z80 SoftCard, is a significant upgrade from AppleSoft Basic. The second disk drive had made it much easier for me to back up my disk, and greatly improved my use of Pascal. The 80-column display makes it much easier to do programming (in Basic and Pascal).

The total cost of my upgrade counting the additional disk drive and monitor, but not counting the Diablo 630, was approximately $2000. The Diablo 630 adds another $2500.

So was it worth it? If one is starting out fresh (with no Apple), this approach to *WordStar* is more expensive than several alternatives that are probably better suited to word processing. However, if you already have an Apple with one or more disk drives and lots of application software, then this is an attractive way of obtaining professional quality word processing while enhancing the general capabilities of your Apple.

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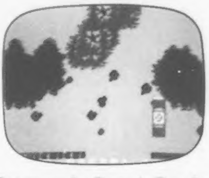

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Three Word Processors For The TRS-80 Color Computer

Scott L. Norman

Let's get the tone of this thing right at the start: I expect to enjoy writing this review, I hope it will be helpful to a few people, and I certainly don't intend it to be an anti-Radio Shack diatribe. That said, I feel compelled to present a bit of history.

creative computing

SOFTWARE PROFILE

Name: Telewriter

System: 16K or 32K Color Computer, cassette or disk drive

Format: Cassette or disk

Language: Machine language

Author: Howard Cohen

Summary: Full-screen editing word processor

Price: $49.95

Manufacturer:

Cognitec
704 Nob Ave.
Del Mar, CA 92014

When the TRS-80 Color Computer was first introduced, the ability to produce color graphics from an inexpensive machine had apparently blinded Radio Shack to the possibility of doing much more with it than playing games. Fortunately, the computer soon attracted a loyal following which took it quite seriously. Many of these people have produced really useful software for the Color Computer, and two such independently-authored packages, *Telewriter* and *C.C. Writer,* figure in this piece. Radio Shack has come around, too; their word processor, *Color Scripsit*, has to be considered a real contender.

creative computing

SOFTWARE PROFILE

Name: C.C. Writer

System: 16K or 32K Color Computer, cassette; 32K computer, disk drive

Format: Cassette or disk

Language: Extended Color Basic

Author: Bill Dye

Summary: Line-oriented system

Price: $35 (cassette); $40 (disk)

Manufacturer:

TransTek
194 Lockwood Lane
Bloomingdale, IL 60108

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SOFTWARE PROFILE

Name: Color Scripsit

System: 4K or larger Color Computer, cassette

Format: ROM pack

Language: Machine language

Author: Robert Kilgus

Summary: Full-screen editing word processor

Price: $39.95

Manufacturer:

Radio Shack
Division of Tandy Corp.
Ft. Worth, TX 76102

Scott L. Norman, 8 Doris Rd., Framingham, MA 01701.

All right, so this is to be a comparison of three Color Computer word processors out of the half dozen or so currently available. Is it really sensible to consider using the machine for this application? Well, I have done about two dozen articles for magazines using all three of these programs. I also use the Color Computer regularly in preparing drafts of reports for my job.

Until quite recently, all of my work was done with a cassette system; two of the three programs reviewed here now support disks—a worthwhile improvement.

Finally, I should say something about doing word processing with the Color Computer keyboard: It isn't all that bad! True, it is closer to a calculator than it is to a typewriter, but the keys are nicely spaced and have good tactile feedback. A reasonable typing speed is attainable. If you want to push matters, it is even possible to retrofit the computer with a standard TRS-80 Model I keyboard; the built-in debounce routine of the Color Computer allows you to really move along.

Enough. This is a software review. Rather than discuss the programs individually, I will describe how each handles the major tasks required of any word processor. In this way, you may find it easier to compare them. I shall reserve most of my discussion of special, unique features for the end of the article. Unless otherwise noted, anything written about *Telewriter* and *C.C. Writer* will apply to both casssette and disk versions.

Text Input and Editing

All three programs use a hierarchy of menus to set up the major operations, and each has some method for keeping the writer informed about the status of the system—e.g. the number of free bytes remaining. *Telewriter* and *C.C. Writer* leave you with about 18,500 and 19,000 bytes of working space, respectively, in a 32K computer. *Scripsit* (I'm going to drop the *Color* most of the time) comes in a ROM cartridge, leaving about 31,500 bytes of RAM for text in the same machine. This may compensate to some extent for its inability to use a disk.

The corresponding text capacities for a 16K computer are about 2100, 4600, and 15,000 bytes, so you can appreciate the effect of program overhead. In my experience, a double-spaced page of text with normal margins requires about 1500 bytes.

Telewriter *manages to put 24 lines of 51 characters on the display and still remain legible.*

The most elementary function of a word processor is the storage and editing of text. These three programs take different approaches to the job; it is even tempting to say that they have different philosophies. *Telewriter* is screen-oriented, meaning that you enter text continuously and can move the cursor over the material at random. Text input, editing, and deletion are not differentiated; you just type. The cursor can be moved one space at a time with the four arrow keys, or it can be zoomed along at high speed by simultaneously pressing an arrow and shift. You can scroll the display forward or backward by one screen page at a time, and you can jump up to the top or bottom of the text, or to the beginning or end of a given line by using an arrow together with the Clear key.

By the way, this is a good time to get used to the idea of a specially-defined "control" key, since each of these programs uses one or more. In the case of *Telewriter,* Clear is generally used to redefine the functions of other keys.

The philosophy behind *Telewriter* is that once you have selected the Edit function from the main menu, your intent is to add text. Therefore if you place the cursor somewhere in the middle of your material and start to type, the new input is just inserted; you don't overtype anything.

Deliberate action is required to erase material. The Break key erases one character at a time from the right of the cursor, while Clear and Break together (but pressed in that order) erase to the left of the cursor.

There is a special procedure for deleting large blocks of material: Move the cursor to the end of the block and mark it with Clear-E, then move back to the beginning of the block and use Clear-X to erase. This is typical of other block-handling procedures we shall discuss. When you have finished moving text around, a special Align command (Clear-A) cleans up the material, insuring that there are no partial lines or awkward divisions of words.

One more thing about *Telewriter:* It employs a software-generated character set to make full-screen editing practical. Material appears on the screen in true upper and lower case (black on green), and the shift keys work just as they would on a typewriter. By reducing the spaces between characters and lines, *Telewriter* manages to put 24 lines of 51 characters on the display and still remain legible. The line length can be changed for printing.

Color Scripsit uses a different approach to full-screen editing. You begin by selecting the Edit Text option from the main menu to start writing. Later, moving the cursor to the middle of existing material and starting to type will result in the new material overtyping the old. You must leave Edit and enter a distinct Insert mode to avoid this.

The *Scripsit* control key is the Break, and Break-3 is the combination which gets you into Insert mode. The text "opens up" to accept new text, with everything after the cursor position dropping down a line. When you have finished making additions, the Clear key closes the text and returns you to Edit mode.

The procedures for deleting text (other than by overtyping) are similar to those used in *Telewriter*. The Clear key deletes the character immediately to the right of the cursor, while the Shift-Clear combination deletes to the end of the next word. There is also a block delete function. First you mark the beginning of the block, then the end, and finally you use the Clear key to actually do the deletion.

Scripsit also allows you to scroll through a mass of text, although there are no commands for jumping by a complete page at a time. You can skip from any point to the top or bottom of the text, however. The *Scripsit* display is certainly unique: everything is in upper case, with capital letters displayed in yellow on a red background, lower case letters the reverse. This can be a little confusing in the beginning if you use a black and white receiver, because the contrast is reversed from that in Basic programs.

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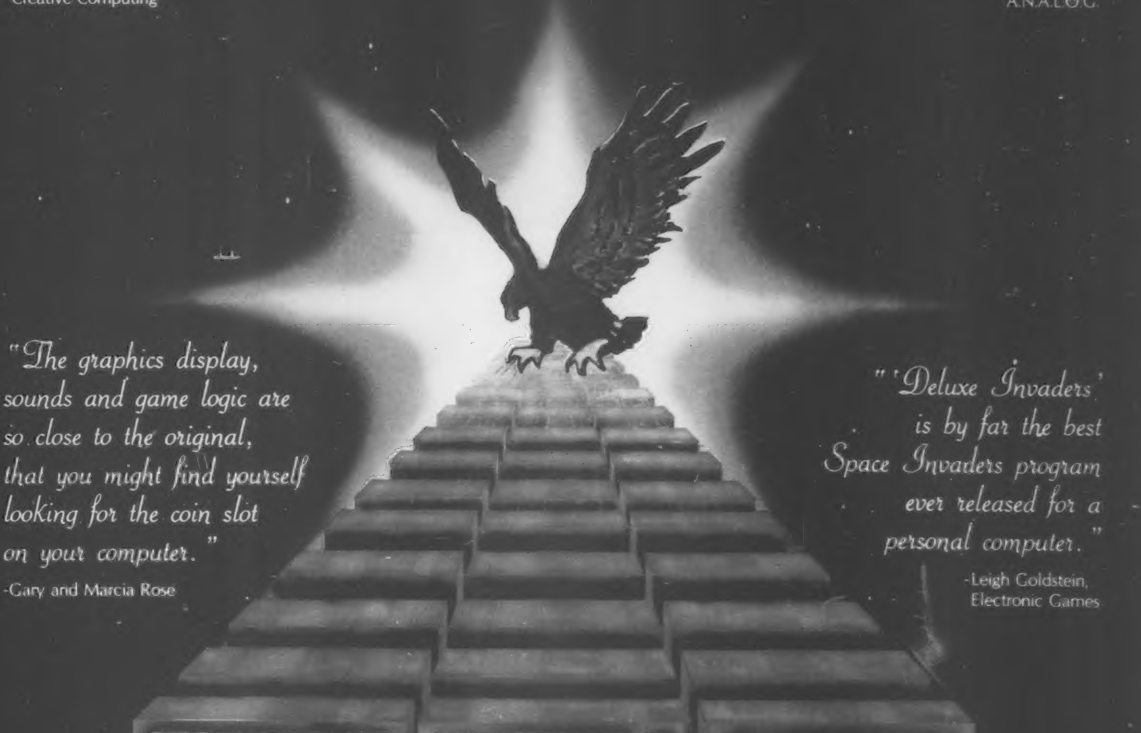
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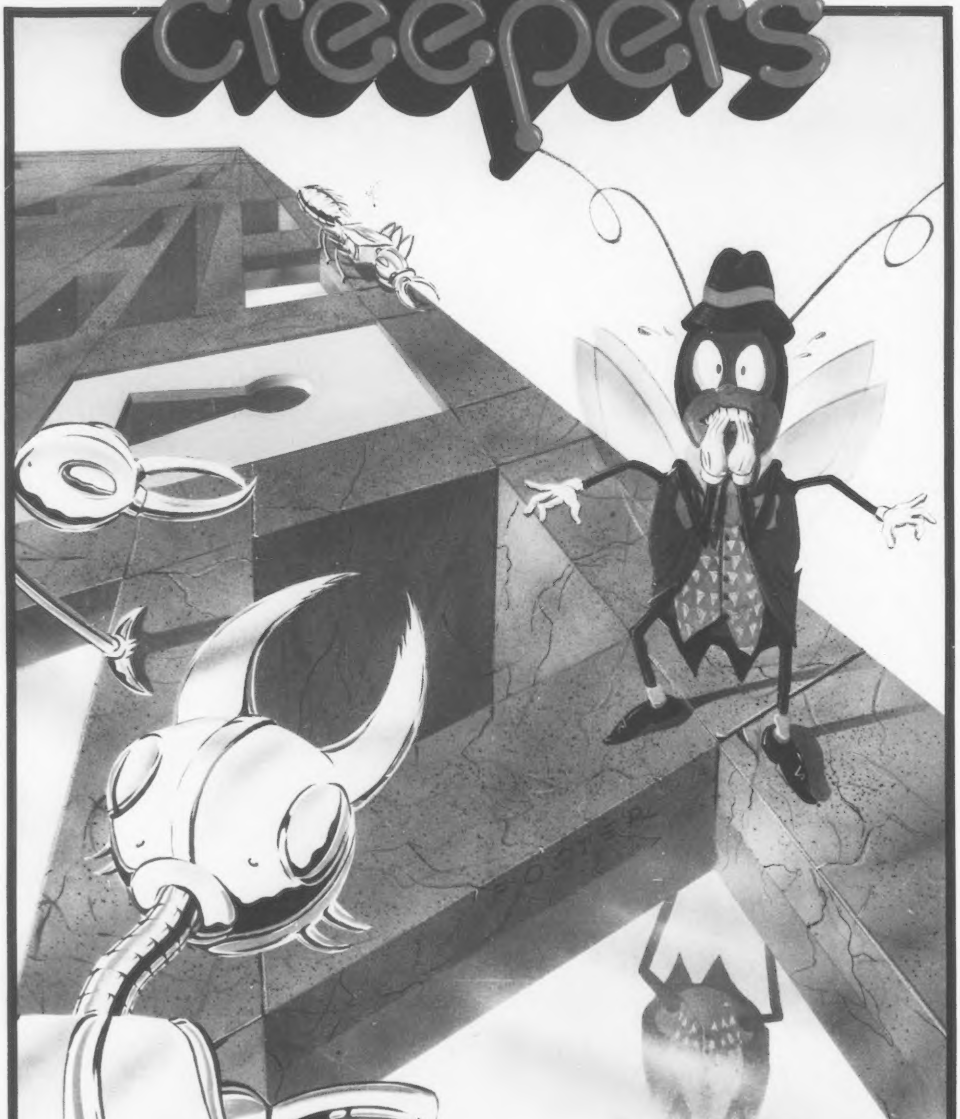

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The conventional display is 32 columns by 14 or 15 lines; one or two lines are reserved at the bottom for status information. When the line length is later reformatted for printing, *Scripsit* shows you how the text will appear. The video display then becomes a 32-column window which can be scrolled horizontally as well as vertically.

C.C. Writer takes a very different tack. It is a line-oriented system which assigns a reference number to every sentence. You must remember to terminate every sentence with an Enter command, rather than typing your text continuously. The program inserts spaces between sentences when printing the text, of course.

With *C.C. Writer,* text entry and editing are completely separate operations. The sole exception is your ability to edit the current sentence before hitting Enter. You can backspace to correct an error, although this erases anything typed after the mistake was made. Once material has been entered, you must leave Enter mode, return to the main menu, and select one of two other modes: Edit, for working within one sentence at a time, or Insert/Delete/Move, for performing one of these three operations on a complete sentence or group of sentences. The Edit mode also has Insert, Delete, and Change submodes.

C.C. Writer ***uses the standard Color Basic font, with reverse video denoting lower case.***

This is beginning to sound much worse than it really is. In practice, you return to the main menu by typing Slash-q (that's right, Slash is the *C.C. Writer* control character), and thread your way through a couple of prompts to arrive at Local Edit. If you know the reference number of the sentence on which you want to work, you specify it; otherwise, keep hitting Enter to invoke the Line Seeker, which allows you to use the arrow keys to scroll up and down through the text. When you find the target sentence, Enter re-invokes the editor. Now, you can move the cursor to the desired position and use i, d, or c to insert, delete, or change material.

A prompting line keeps you informed as to which mode or sub-mode is in operation at any time. Insertion works just as for *Scripsit,* deletion is performed one character at a time by depressing the d key, and change is an overtyping operation. You must work your way back to the main menu eventually, but this is made easy by the generous use of prompts.

Large chunks of text must be deleted one sentence at a time. The Delete option of the Insert/Delete/Move command is selected, and you are prompted for a line number. If you specify one, the computer prints the line and asks you to verify your intent to delete it. If you agree, the line is killed and you are asked to specify another. If you have specified the wrong line, a negative answer saves it and returns the prompt.

Incidentally, only the cassette version of the program uses the three-way Insert/Delete/Move. The disk version has separate commands for each of these options.

C.C. Writer uses the standard Color Basic font, with reverse video denoting lower case. Relatively little text is visible at any one time, because of the start-of-line prompts and reference numbers.

Embedded Commands

Word Processors must provide for embedded comands—special instructions for modifying the text format as it is printed. These must be incorporated into the text, and the program must recognize them as commands and execute them without printing their literal form. Special control characters are the order of the day.

Telewriter uses the Clear-Period combination to generate a small carat, which can be followed by one or more commands. The commands themselves are much the same as those used by the print formatting menu, namely a capital letter followed by a number. For example, M20 resets the left margin to 20 spaces, and C40 tells the printer to switch to 40-character lines.

Embedded commands must appear on their own lines, without other text, and must be indented by at least one space. You can "stack" several of them on one line, and there is no particular order in which they must appear. There is a fairly complete set of such commands, including five which control the fonts of an Epson MX-80 Printer, and provision has been made for the user to define his own commands. These would normally be strings of ASCII control codes to be executed by the printer.

The embedded command syntax is also used for a few other purposes: centering a line of text, aligning partial lines with the left margin, or defining a header to be printed at the top of each page, for example. One thing which *Telewriter* unfortunately does not provide for is the setting of tabs. It comes with predefined tabs every eight positions, which is really too much for indenting a paragraph. You must, therefore, punch the spacebar five times or so to get indentations.

Color Scripsit is a little less versatile in this area. You can set tabs, center a line, define headlines and footers, and change from left to right-justification, but that's about it. Line length, and margins, to mention a couple of major parameters, can be set only once for the entire document. This is unfortunate, because a standard method of setting off a direct quotation or other material is to print it with wider margins (shorter lines) than the main text, perhaps single-spaced in an otherwise double-spaced manuscript. You can adjust the margins with judicious use of tabs, but is not convenient.

The embedded commands in *Scripsit* are set with the Break-number key combination. Tabs are set by spacing over the desired distance and hitting Break-5, for instance. The manual describes a much more complicated procedure, for unknown reasons.

To change line alignment, you place the cursor on any blank space in the line on which you want realignment to begin, and enter Break-6. A three-option menu comes up, giving you a choice of flush left, flush right, or centered text. Note that "flush right" is not right justification, i.e. the padding of text with extra spaces to fill the lines. In any case, after you make your selection it is marked in the text by a nonprinting character, a green-and-black graphics block. All of the alignment commands are toggled and remain in effect until reset.

In *C.C. Writer,* embedded commands appear at the beginning of the first line to which they are relevant. They take the form of a slash (/) followed by a lower case letter and a number where appropriate. For example, /c centers the following line, /s4 skips four lines, and /p skips one line and starts a new paragraph (the indentation is set in the print format menu). There is limited control of line length: the /i command indents both margins by five spaces until cancelled by another /i. There is an implied hierarchy to the commands, but it rarely causes any problems.

Other Editing Functions

I have already described how the three programs go about deleting blocks of text. All three also have the ability to move pieces of text around, which is one of the great features of word processing. *Telewriter* and *Scripsit* handle this job in similar ways: the beginning and end of the block are marked, and the move is then accomplished by designating the new location. *Telewriter* uses Clear-B to mark the beginning, Clear-E for the end,

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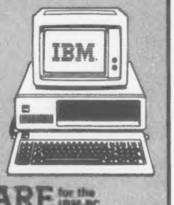

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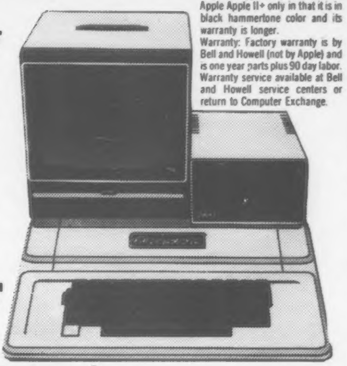

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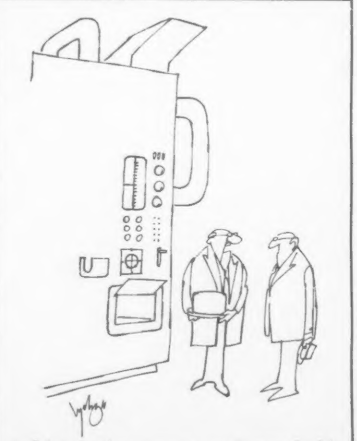
and Clear-C to copy the block to its new location. This is a copying operation, not simply a move, so the original block must still be deleted. *Scripsit* uses only one command, Break-9, to mark all three locations of interest for a move. If you want to copy a block of text, use Break-: for the three commands.

With *C.C. Writer,* you must call up the Move command (disk version) or option (cassette version). You then use Line Seeker to move through the text to the beginning and end of the selected block, which you identify by entering B and E. Finally, you move to the sentence in front of which you want the material to be inserted, and enter T (for Target) to complete the move. There are no provisions for copying material.

All three programs have provisions for finding a specified character string and either changing it or not, at your option. In *Telewriter,* Clear-G allows you to specify both the character pattern to be found and its replacement. With the text screen on display, Clear-N causes the cursor to jump to the next occurrence of the search text; Clear-R causes a specific occurrence to be replaced. You can get pretty speedy at this by holding down the Clear key and alternating between N and R with two fingers of the left hand.

You can use this technique with a null entry as the replacement string to delete selected occurrences of a word or phrase.

Scripsit works in similar fashion, with Break-7 as the command for specifying the target and replacement strings. The Enter key steps you through the text from one occurrence to the next, and at each one you have the option of changing, leaving unaltered, or changing all subsequent occurrences of the target.



"...It's a word processor,...we just made this 12 layer fudge torte from 6 volumes of the decline and fall of the Roman Empire..."

And *C.C. Writer*? Here you have the Global Edit command or option, which will prompt you for the traditional two strings. At every occurrence you can enter n to skip, or just use the enter key to make the replacement.

Print Formatting

Although embedded commands take care of incremental changes, all three word processors need separate format menus to set most of the parameters which govern the appearance of the printed page. The degree of control varies quite a bit between programs.

> **Scripsit *offers the option of recording files on tape in ASCII format, which means that it can be used to compose and edit Basic programs.***

The format menu for *Telewriter* is the most elaborate, largely due to the provisions made for interfacing with the MX-80. It also affords the user an opportunity to change the baud rate for transmission from computer to printer; the default is 600 baud, but there are provisions for going as high as 4800. Of course, conventional print parameters such as side, top, and bottom margins; line length; and spacing can all be controlled.

A single-letter command is used to generate a flashing cursor next to the desired command; the default values are all displayed, so it is an easy matter to decide which ones you want to change. One which will almost certainly change is the number of characters per line. The default is 50 to match the width of the screen display, but 60 is a much more reasonable value for printing on 8½ x 11 paper.

One useful feature is the ability to print only a portion of the material in the text buffer. This is especially useful for previewing a piece of text with a complicated format, for example. It just calls for a little coordination. First, the end of the desired text block is marked with Clear-E while in the Entry/Edit mode. The cursor is then moved back to the beginning of the block, and the Clear-M command is given to return to the main menu. Now the F command gets the format menu, and finally the % key performs the desired partial print. There is an analogous partial save command for recording part of the text buffer to tape.

As I shall discuss a little later, *Telewriter* supports chain printing—the stringing together of several text files from tape or disk to create a long document. The format menu controls this by asking for the number of files in the queue. This should be one less than the total number of files you plan to print, since the first one must be loaded into RAM before you start printing.

Color Scripsit employs a considerably shorter format menu, which it calls standards. It affords control over the basic size parameters, though, and includes a couple of special features: the option to print in all capitals and a hyphenation minimum. The former would seem to be a real curiosity, until you consider that *Scripsit* offers the option of recording files on tape in ASCII format, which means that it can be used to compose and edit Basic programs. The all capitals option must be used if such files are to be read properly by the Color Computer.

What about hyphenation? *Scripsit* can identify words which are candidates for hyphenation, so that their first halves can be moved up to help fill out a short text line. This can improve the appearance of a printed document. To invoke hypenation from the Edit mode, use the command Break-8. The cursor will move to the first word that can be hyphenated, although it may not stop at the first letter of a syllable. Move it back with the left arrow key until it is so positioned, and press Break-0. The letters to the left of the cursor will shift up to the end of the previous line, followed by a hyphen. Normally, the program will identify words that can be hyphenated if at least three characters fit on the previous line; this is the "hyphenated minimum" which can be changed on the standards menu.

Scripsit has one quirk which must be taken care of with this menu. The default for the number of print lines per page is 66, which is appropriate for an 11" page; however, if you plan to print a double-spaced document, you must change this to 33 to locate page numbers, headers, etc., properly. The two other programs can figure this out for themselves.

The format menu for *C.C. Writer* called Page Controls, is fairly elaborate. It includes options for pausing at every page break, ejecting the last page of a document, setting the paragraph indentation, and specifying a header to be printed on every page but the first (the other programs incorporate headers with the text). It is unique in that it also has a true right justification option. It can also be a little maddening, at least in the cassette version, because to change

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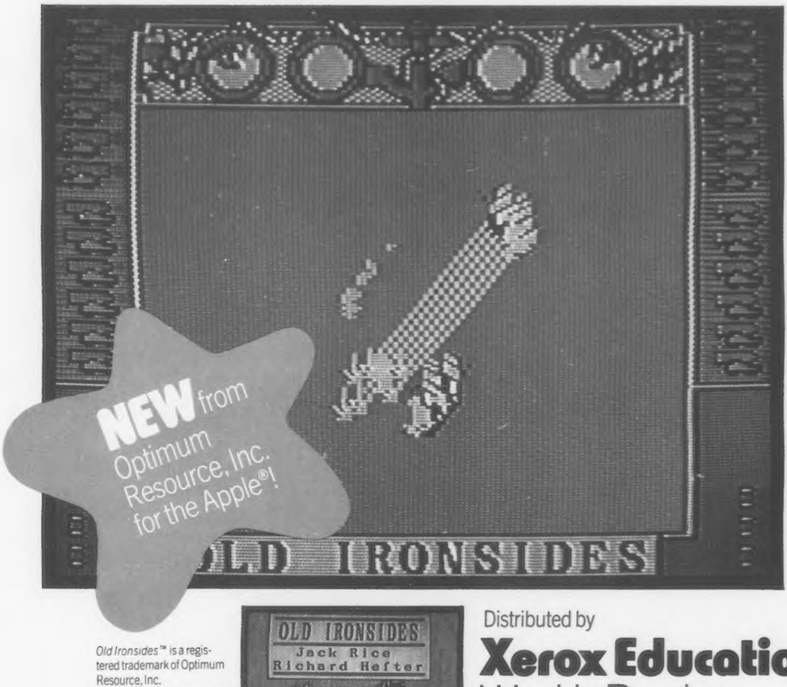

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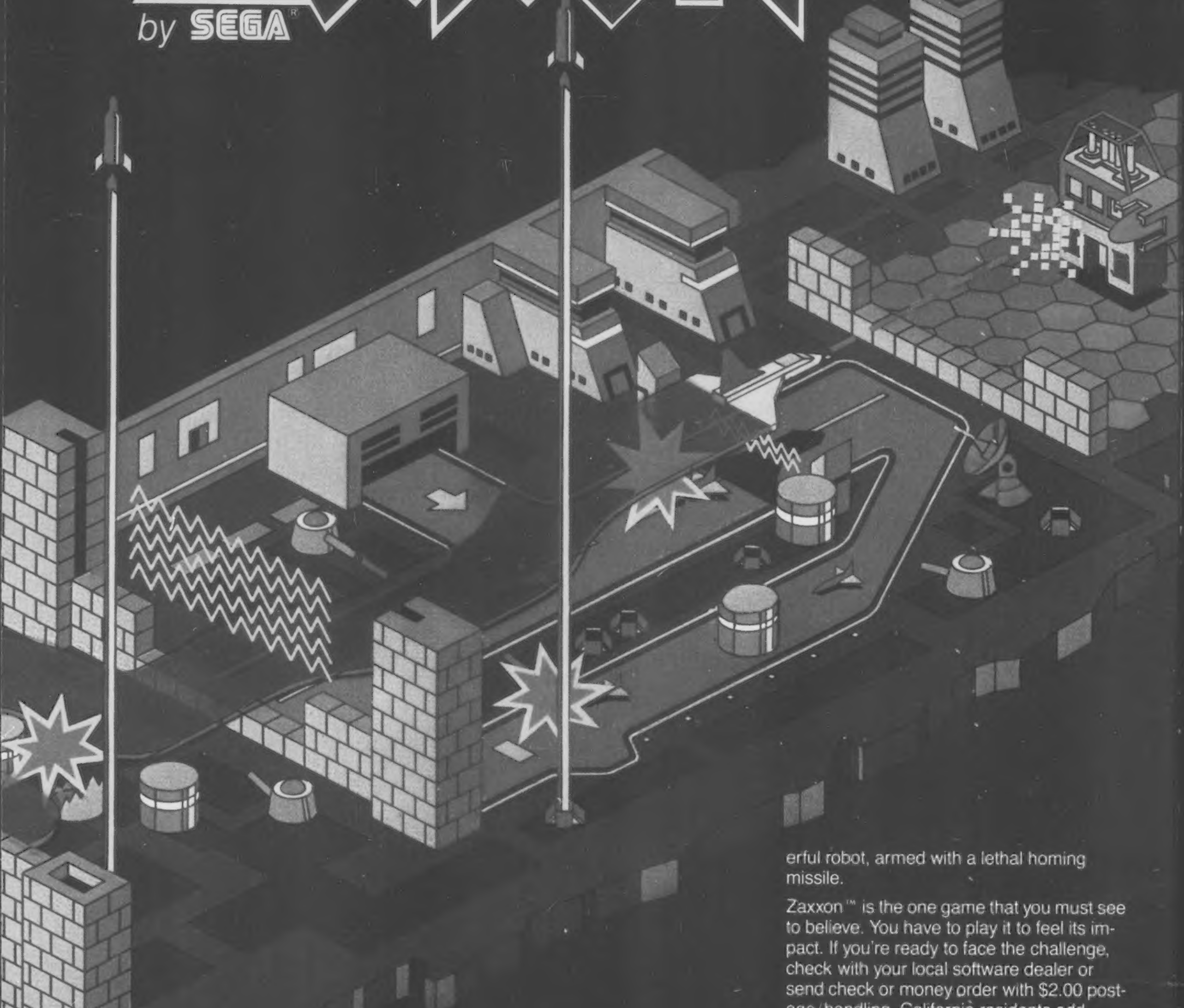

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one of the parameters you must review the entire menu twice.

You must step the cursor through every option even if you decide to change nothing; change one parameter, and you must review the whole list again. It increases your chances of getting the setup you want, I guess. Things are somewhat better with the disk version in which your personalized defaults are stored and called up for each document.

Handling Storage Media

The three programs vary in the degree of flexibility with which they interact with tape or disk. *Telewriter* and *C.C. Writer* allow you to chain files together during printing, while *Scripsit* relies on its larger buffer to hold anything you might want to print. I have already mentioned that *Telewriter* requires the number of files in the tape queue to be specified: with *C.C. Writer,* you use an embedded command to specify the next file to be printed. The syntax is /d followed by the next filename, and this must be the last line in a file.

The inability of *Scripsit* to chain print can be a liability; the draft of this review comes close to filling its buffer, for instance. Of course, you can always print one file, manually position the tape and read the next file into memory, print that one, etc., but this is awkward. The text would be broken up with large white spaces, too, because *Scripsit* automatically advances to the top of the next page after finishing a printout.

Telewriter *and* Scripsit *share the ability to append a recorded file to whatever is in RAM.*

Each program has a noteworthy media-handling feature or two. I have already mentioned the *Telewriter* Partial Save. Another particularly useful command is verify, which allows you to check the integrity of a recorded file before clearing RAM for further work. This is of particular value when working with a 16K computer and cassette recorder; I have written things that required the chaining of more than 20 files, and you'd better believe that I was in no mood for an I/O ERROR message in the midst of a printing session.

Telewriter and *Scripsit* share the ability to append a recorded file to whatever is in RAM, assuming the two will fit. *Telewriter* even gives you a detailed message if the sum of the two files is too large and tells you the amount of overflow. The main menu command for the append function is A; a special command is needed because a normal read destroys whatever was in the text buffer. The *Scripsit* read operation (Command 2 from the main menu) is nondestructive in this sense, so the same command can be used to append text.

The disk version of *C.C. Writer* has a very nice feature: single-keystroke commands to make a backup copy of whatever is in the text buffer. A B command from the main menu will cause the text to be written to a disk file called BACKUP/CCW. Entering an isolated lower case b from the Type (input) mode will do the same thing—very handy if you want to leave the keyboard for a few moments in the midst of a long session.

Some Opinions

In this review, I have tried to give you a feeling for what it is like to work with *Telewriter, Color Scripsit,* and *C.C. Writer.* Of course, almost every aspect of each of these programs has subtleties that I haven't discussed. There would be no point in my reproducing the instruction manuals, after all. What I would like to do, though, is share a few impressions I have gained through working with the three programs. These are highly subjective, but they may still be of interest to anyone contemplating the purchase of a Color Computer word processor.

I think that the strongest of *Telewriter's* features is the free-wheeling mode of operation which its full-screen editing promotes. My own writing style is rather loose and floppy; I skip back and forth to change the last paragraph, add to the current one, and so on. Somehow, *Telewriter* seems to fit my undisciplined style; switching between text entry and correction modes just slows me down.

The relatively high-density format helps, by making so much of the text visible at any time. All in all, I think *Telewriter* gives the user the best control over the appearance of the final printout, too, although I still regret the absence of a tab setting command.

Color Scripsit does almost everything I need, but a few things do get in the way. I have mentioned the lack of file chaining, which would never come up at all if I wroter shorter pieces; the inability to scroll back and forth by a page at a time; and the requirement to go into Insert mode to add text to the middle of a file.

To these I should add the use of redefined number keys, rather than letters, for commands and menu selection. The simple fact is that there is no mnemonic relationship between Break-5 and the tab setting function; wouldn't Break-T have been better? At the very least, Radio Shack should furnish a keyboard overlay with this package. The procedure for defining headers and top and bottom margins also seems more cumbersome than necessary.

What do I like about *Scripsit?* Well, I think the hyphenation function is neat, and so is the Print to Tape option which writes files in ASCII format. The concept of using a word processor to compose a Basic Program seemed a little strange to me at first, but the ability to find and change character strings has come in handy for renaming variables and for adjusting line numbers in the middle of a program. This dual-purpose operation might be an important consideration if you are really interested in keeping down the cost of your software library.

Together with other recently announced word processors, these three give Color Computer owners quite a reasonable choice.

The ability of *Scripsit* to print text flush against the right margin is useful for special jobs such as return addresses on business letters, but it doesn't take the place of true justification. I think that the appearance of correspondence is much improved by straight left and right margins. This is the unique province of *C.C. Writer,* at least among the three programs discussed here.

The *C.C. Writer* justification routine is too slow to be useful for a long manuscript, though. This may be due in part to the program being written in Basic—another unique point. The advantage to this, of course, is that you could probably "customize" your own copy of *C.C. Writer* fairly easily.

The Bottom Line

Here's the bottom line: Each of these programs has its strengths, although differences in working styles could make for some real mismatches between writers and software in individual cases. Together with other recently announced word processors, these three give Color Computer owners quite a reasonable choice in applying their machines to professional and personal writing.

Try to think about your own needs and style of operation, and make allowances for future development of both when selecting one. ☐

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Epson HX-20 Computer

If you have picked up just about any computer magazine in the last six months you have probably seen the double page ad spread in which the Epson HX-20 is pictured full size. Indeed, the unit could almost have been pictured on a single page, since it measures just $8\frac{1}{2}$"x $11\frac{3}{8}$". Its height is a diminutive $1\frac{3}{4}$".

But that's nothing new, you say. The Sinclair ZX80 is about one half the size of the HX-20 and it has been out for several years. True, but at the risk of offending scores of loyal Sinclair owners, let me observe that the Epson has a great deal more capacity and capability built in. I was tempted to say that the HX-20 is a "real computer," but that would have been a low blow, and incorrect too—the ZX80 and 81 are as real as any.

In addition to small size, the other main thing that sets the Epson apart from the field is built-in battery power for true portability.

While we cannot report definitively about reliability and support, we speculate that they are likely to be excellent, given the outstanding reputation of Epson in the printer market. For a "one of the pack" company three years ago to emerge as the dominant supplier of dot matrix printers worldwide indicates they are doing a lot of things right. Contributing to this success is undoubtedly some guidance from the Seiko parent company, but mainly an excellent management team in the U.S., Japan, and other countries.

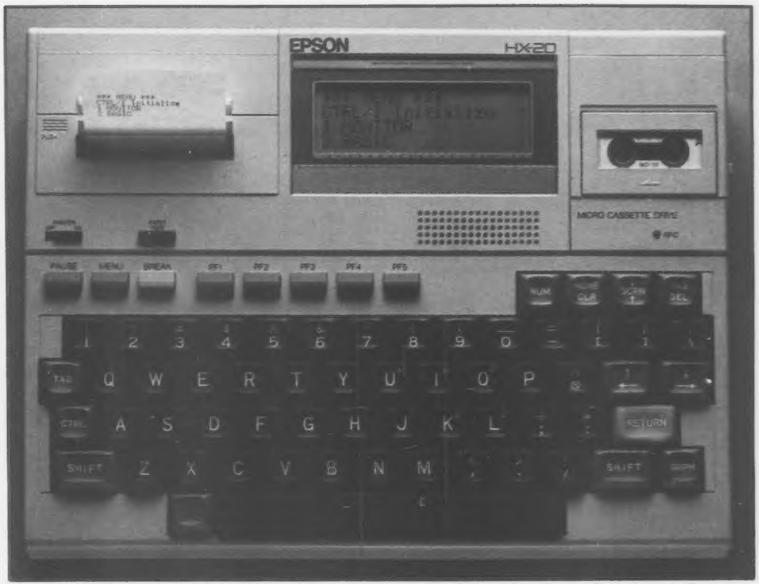


Figure 1. Top view of HX-20. The computer is about the size of a piece of paper.

David H. Ahl

A Compact Portable

As mentioned above, the HX-20 is about the size of a three-ring binder and, at $3\frac{1}{2}$ pounds, not much heavier. It fits easily into an attache case or slipcase. Unlike some portable videotape machines that require a battery which weighs nearly as much as the machine itself, the HX-20 rechargeable battery is built-in and included in the $3\frac{1}{2}$ pounds. The nickel-cadmium batteries can keep the HX-20 running for 50 hours, yet need only eight hours to recharge. This is very impressive since most ni-cad battery run time to charge time ratios are just the opposite.

Most calculators today, even the least

Figure 2. Right side view of HX-20.

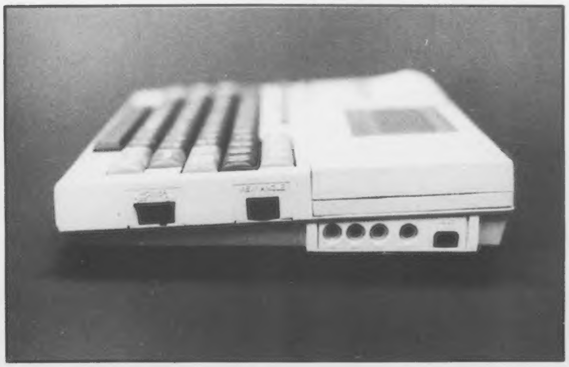
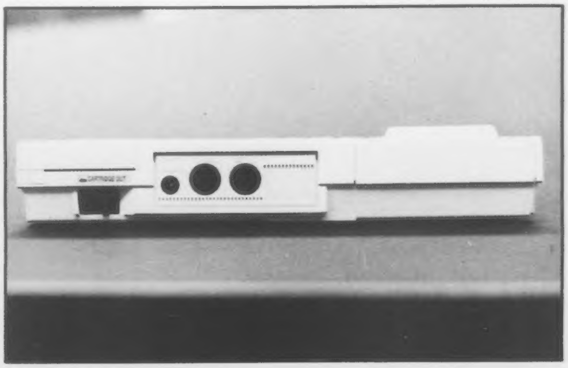


Figure 3. Rear of HX-20.



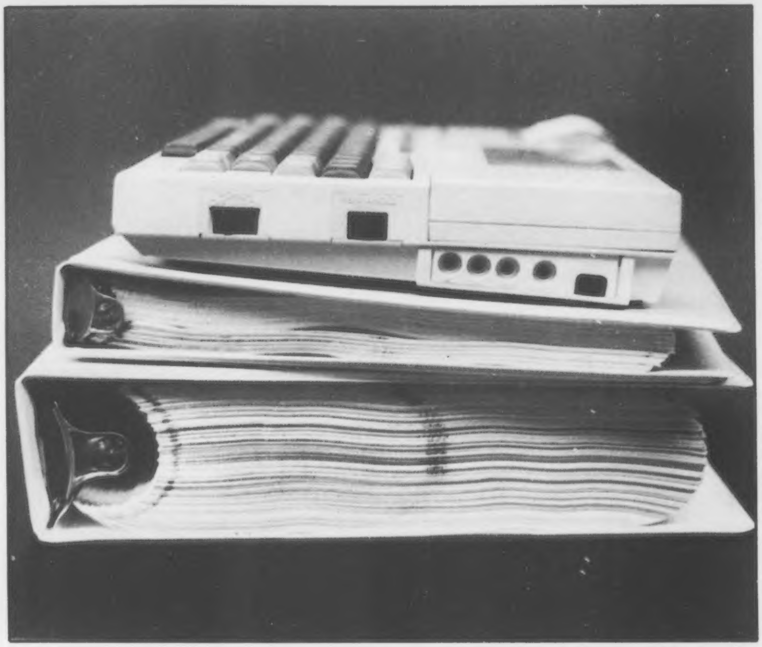


Figure 4. The preliminary documentation was nearly three times as big as the computer. The final typeset and printed documentation is more manageable.

expensive units, have an automatic shut off. For example, APF units shut off automatically if nothing has been pressed after seven minutes. The HX-20 lacks this feature which I found a bit surprising.

However, when the HX-20 is shut off, it continues to trickle a small amount of power through the all-CMOS memory, thus keeping intact all the contents in memory. As long as the unit is recharged from time to time, these programs and data will be stored indefinitely.

Full Stroke Keyboard

The keyboard of the HX-20 is in the standard QWERTY layout with a few extra keys on the right side. In particular, in addition to letters, numbers and the usual symbols, the HX-20 includes two kinds of brackets, four directional arrows, and five keys for providing instructions to the computer. These keys include home/clear, insert/delete, scroll up/down, number, and graph.

The number key is, in effect, a type of shift key which engages a numeric keypad using the keys, m,j,k,l,u,i,o,7,8, and 9. The graph key is also a type of shift key which produces block graphics and symbols from the keyboard.

Above the keyboard to the right are eight function keys. Three functions are built-in: pause, menu, and break. The five other function keys may be programmed by the user.

As its name implies, the pause key causes a running program to halt temporarily. Hitting any key causes it to resume.

The menu key brings up a menu on the screen. On the menu, Number 1 is always Monitor, 2 is Basic, and 3 through 7 are user-written programs. More about this later.

Break halts a running program and returns to Basic. The contents of memory are not altered upon pressing it.

The five programmable function keys come from the factory with certain functions preset:

Key	*Standard*	*Shifted*
1	AUTO	Date/Time display
2	LIST	LOAD
3	LLIST	SAVE
4	STAT	TITLE
5	RUN	LOGIN

Functions such as LIST and RUN execute the command when the key is pressed. Other commands such as LOAD and SAVE appear on the screen followed by a space and wait until the user fills in the rest of the command.

Recessed on the right side of the computer toward the rear is a reset switch. Pressing it interrupts the computer and calls up the initial menu. Also on the right side is an off/on rocker switch.

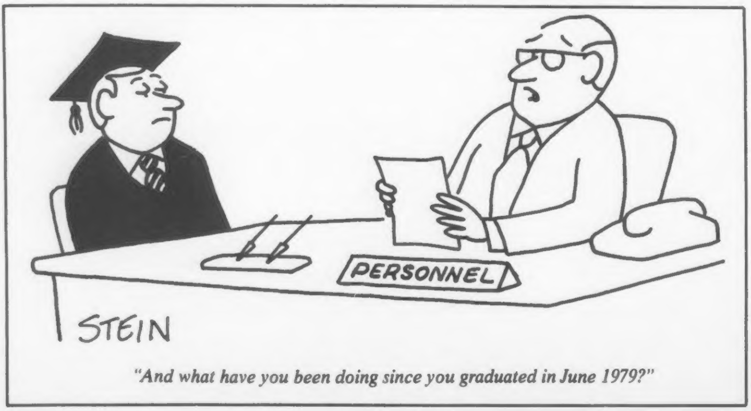
Other external controls include two for the printer, an off/on slide switch and a paper feed button. A rotary view angle control on the left side actually changes the angle of the LCD elements of the viewscreen slightly to suit your operating position. You simply turn the knob until maximum contrast is achieved.

An Open Window

The display is a 20-character by 4-line liquid crystal display (LCD) unit. It is unlike a calculator in which each number is formed from a combination of seven line segments; instead, the screen consists of 120 x 32 pixels or dots. Characters are formed within a 5 x 7 dot matrix. This means, of course, that lower case letters do not have real descenders as they do on full screen video displays.

The screen is actually a "window" onto a much larger virtual screen. The size of the virtual screen can be defined by the user to be between 20 and 255 characters wide and 4 to 255 lines high. This does not mean that you can define a screen measuring 255 x 255, because that would require far more memory than is available in the HX-20.

The window may be moved horizontally and vertically with the arrow keys or, within programs, by using four Basic language commands: width, scroll, locate and locates. The locate command



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moves the cursor anyplace on the screen and automatically displays that portion of the screen in the display window. Locates allows you to display any desired portion of the virtual screen in the LCD display window.

Although the text is formed of pixels, Epson has chosen to offer two independent display modes, text and dot-addressable graphics. On the HX-20 LCD display, these two display modes may be superimposed on each other; this is not possible on an external monitor or TV set.

As delivered, the HX-20 does not drive a monitor or TV set; an extra module, which was not available at the time of this evaluation, is necessary. The specifications I was given for the display dimensions on a monitor or TV set sound a bit strange—32 characters by 6 lines. The graphics display was quoted as 128 x 96 pixels in monochrome or 128 x 64 in four colors.

Our friends at *Personal Computer World* in England tell us that if you use color, a bizarre addressing mode, in which there are 64 physical pixels vertically but 96 addresses, prevails. Hence, either 0,0 or 0,1 will light the pixel at 0,0, but only 0,2 will light 0,2 and so on, alternately. That could lead to some "interesting" effects.

Dual Processors

The HX-20 represents a sharp departure from conventional microcomputer architecture. It uses two 6301 (huh?) microprocessors, designed and manufactured by Epson. They are supposedly compatible with the Motorola 6800. Other computers with multiple MPUs usually use one for processing and memory control and the other for I/O and display functions. In contrast, the MPUs in the HX-20 are in somewhat more of a master/slave relationship.

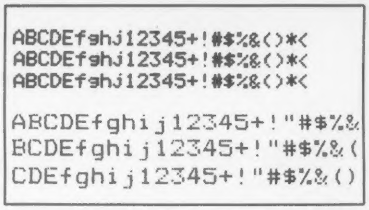
The master MPU does the processing and also controls the memory, keyboard, display, clock, and barcode reader using external ROM while the slave MPU controls the printer, cassette recorder, RS-232 and high-speed serial ports, and the trickle power function when the unit is turned off. For these functions, the slave uses 4K of ROM which is on the MPU itself. Also on each MPU are 128 bytes of RAM. The two MPUs communicate with each other by means of a 38,400 baud serial link rather than the parallel link that one might expect.

The HX-20 is delivered with 16K of RAM which is optionally expandable to 32K with an external module. We expected that a compact unit like the HX-20 might use 64K memory chips. It does not; the built-in 16K is in the form of eight 16K bit chips. However, the 32K of ROM which contains the monitor, Basic language, and the like is found on four 64K bit chips. There is also a spare socket for 8K of expansion ROM.

The screen is actually a "window" onto a much larger virtual screen.

Built-in Printer

On the top left of the HX-20 a small adding machine type printer is found. It uses rolls of plain paper $2^1/_4''$ wide. It appears that standard adding machine tape can be used in the printer. The ribbon cartridge looks like a miniature version of the one in the MX-80 printer and is unexpectedly easy to replace.



```
ABCDEfghj12345+!#$%&()*<
ABCDEfghj12345+!#$%&()*<
ABCDEfghj12345+!#$%&()*<

ABCDEfghij12345+!"#$%&
BCDEfghij12345+!"#$%&(
CDEfghij12345+!"#$%&()
```

Figure 5. Print sample from the HX-20 computer and MX-80 printer. Note the tighter 13 characters per inch spacing on the HX-20 print compared to the 10 cpi spacing of the MX-80.

Up to 24 characters can be printed on one line 1.85" in length. The characters appear smaller than those produced on other printers, but are equivalent to 9-point type (the same as the type in this article). In fact, the MX-80 also produces 9-point type. The difference is in horizontal spacing of characters; the MX-80 and other similar printers print 10 characters per inch while the HX-20 packs 13 characters per inch.

For printing of graphics, this closer spacing leads to a crisper image than that produced by many dot matrix printers. Built into the firmware is a simple routine to get a screen print. Also, as mentioned above, LLIST is function key 3.

Printing speed is roughly 17 characters per second or 42 lines per minute. The printer sounds like a swarm of angry hornets being driven from their nest. The MX-80 sounds like a church mouse by comparison.

The HX-20 can drive an external printer, however, at the time of this test we did not have an interface cable or the documentation to build one.

Beeps and Boops

Behind a $^1/_2''$ x $2''$ rectangle of holes under the LCD display is hidden a speaker. Well, not exactly. It is a piezoelectric device which can be programmed to beep and boop at different pitches and durations.

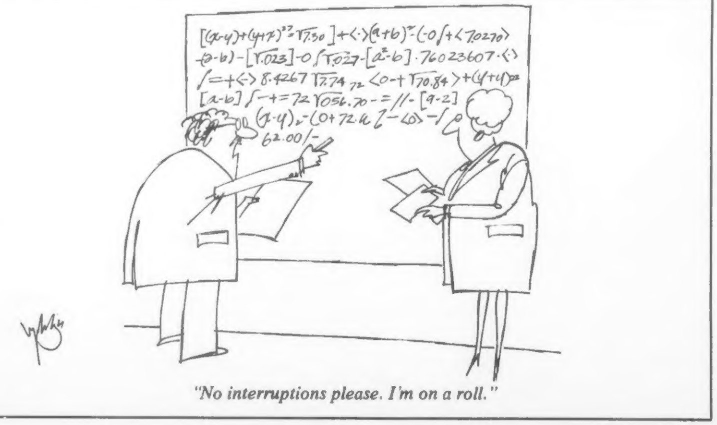
Within Basic is a command, SOUND p,d. The parameter p corresponds to pitch (four-octave range); while the parameter d corresponds to duration in tenths of seconds.

External Devices

Two external devices have already been mentioned, a printer and a monitor or TV. To connect to these and other devices, the HX-20 has two DIN connectors on the back. An 8-pin socket is for RS-232C devices such as terminals, printers, modems, and even other computers. It communicates at speeds up to 4800 baud.

A second 5-pin DIN socket has a maximum transfer rate of 38,400 baud for communicating to disk drives or, with an adapter, to a monitor or TV set.

On the right side are four mini sockets, three of which hook up to an ex-



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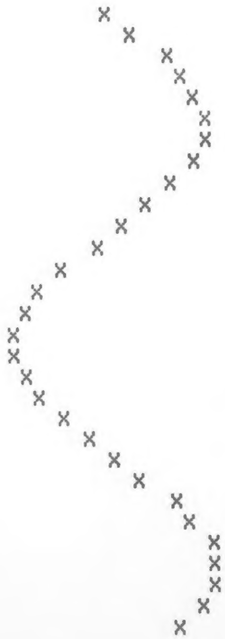
ternal cassette recorder. One socket is for input, one for output, and the third for motor control. The fourth mini socket is for a barcode reader.

On the left side is a flat connector normally covered by a piece of black plastic. This is a parallel connector for a 16K expansion RAM memory module.

An optional device which, if installed, occupies the top right of the case is a microcassette recorder. This same space can also be occupied by optional ROM software modules. The microcassette recorder is a digital unit, not audio, although it uses standard microcassettes. It reads and writes at a speedy 1300 baud and can store about 50K bytes of data or programs on a 30-minute cassette. This is equivalent to about 40 double-spaced typewritten pages. A nice feature is an accurate tape counter which allows fast winding to a program or area of data before loading. This is not a manual counter as found on other recorders, but is in software. Very neat!

Figure 6. Short HX-20 program to print a curve of a sine wave on the built-in printer.

```
5 CLS
200 I=0
210 A=8+8*SIN(I)
220 LPRINTTAB(A);"X"
230 I=I+.3:GOTO210
```



The only other external device is a 6-volt power supply that plugs into the back of the HX-20. This is normally used for recharging and not for computer operation, although it can be if the batteries are low and you simply must use the unit.

Basic Language

Epson Basic, called EBasic appropriately enough, is similar to Microsoft Basic, but was written by Ski Soft, Inc. of Cambridge, MA.

To enter Basic, you simply select Option 2 from the menu. Almost like a mini-timesharing system, the HX-20 gives you a choice of five program areas. If you do nothing, you will automatically be in P1 (Program Area 1). To get into another area or program, you use the LOGIN command. If you want your program to be added to the menu list, you simply give it a TITLE and it will automatically become the next one on the list.

Once a program has a title and is on the menu list, it cannot be written over. Even giving the command NEW will not erase it. This is a very valuable protection device. Actually, it took me some time to find out how to get rid of a program; a null title seems to be the answer, i.e., TITLE"".

The printer sounds like a swarm of angry hornets being driven from their nest.

Good editing functions such as automatic line numbering starting wherever you wish, line renumbering, delete, and non-destructive cursor movement are provided. Basic also provides a STAT command for getting the statistics on all the programs in the machine (title, size, available memory).

The pause has a second very useful function when writing programs. In particular, it can be pressed while a program is listing. Remember, you see only four or fewer lines on the display. By pressing a number after pause you automatically set a scroll speed from very slow (9) to very zippy (1).

To debug a running program, EBasic incorporates a trace mode. The command TRON turns on the trace mode. What this does is show on the display the line number of each new line as it is executed. Trace can be turned on and off from the keyboard or from statements embedded in the program.

```
100 CLS
110 '
120 DISPLAY$=TIME$
125 LOCATE 6,1,0:PRINTDA
TE$
130 LOCATE 6,2,0:PRINTTI
ME$
140 SOUND5,1
150 IF DISPLAY$=TIME$ TH
EN 150
160 GOTO 120
```

```
      11/09/82
      17:56:25
```

Figure 7. Program to make the HX-20 into an expensive digital clock. the date and time are displayed in the center of the screen. The program "beeps" as each new second is displayed.

Basic has the usual numeric and string variables. Variable names may be up to 16 characters long and must begin with a letter. Certain words that mean something in Basic are reserved and may not appear in a variable name. For example, NOTE is an illegal name because it begins with the reserved word NOT. There are 137 reserved words.

Commands may be issued in either upper or lower case; the HX-20 is case insensitive in this case (groan). Thus, although output statements (PRINT, LPRINT) will preserve upper and lower case, the Basic language itself doesn't care. To it, the variable names MAX, Max, and max are all the same.

Under the default conditions, the HX-20 allows for up to 200 characters in the string variable workspace. If this is not enough for a given program, the string space can be enlarged by the command CLEAR. For example CLEAR 1000 clears out an area which can store up to 1000 characters. However, a large string space does not mean that you can have one string that is 1000 characters long; the maximum length of one string variable is 255 characters.

EBasic has a rich library of 38 numeric and 13 string functions. The expected math and trig functions are present as well as many graphics and numeric conversion functions. The early copy of the manual with our HX-20 did not have all the functions fully defined or explained; some of them looked most unusual.

Three interesting functions are DAY, DATE$, and TIME$. Since low power is continuously applied to the memory of the HX-20, why not put in a piece of quartz and let the computer tell the day, date, and time (particularly if your parent company is Seiko)? That is what the designers did, hence, once entered, these

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"Gosh, wouldn't it be nifty?" exclaimed J. R.

But alas, the lack of appropriate hardware prevented him from accomplishing his goal.

J. R. looked everywhere in his local computer store for an interface or expansion board to solve his dilemma, but none were designed for the magnificent project he had in mind.

"Shucks . . ." he stormed, "what am I to do?"

Poor J. R.

But then, just as he was about to give up all hope, a splash of color caught his eye over in the book section . . .

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J. R. left the store, also an IJG book dealer, a very happy man.

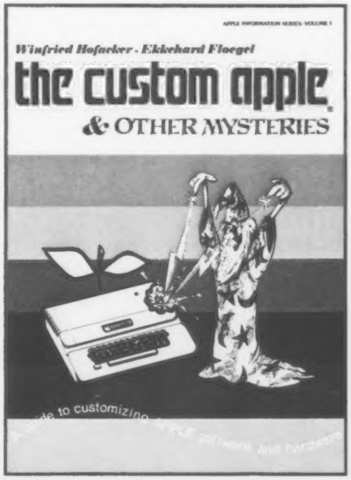
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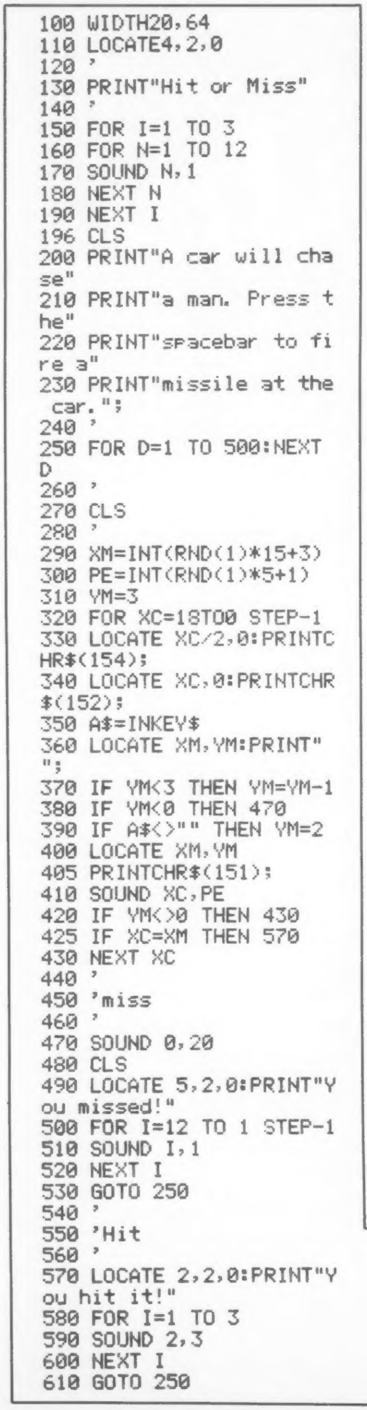
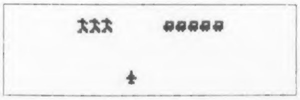
Figure 8. A simple game, "Hit or Miss," is in the manual. In it you must fire a missile from the bottom of the screen to intersect a car at the top before it hits the running man.



```
100 WIDTH20,64
110 LOCATE4,2,0
120 '
130 PRINT"Hit or Miss"
140 '
150 FOR I=1 TO 3
160 FOR N=1 TO 12
170 SOUND N,1
180 NEXT N
190 NEXT I
196 CLS
200 PRINT"A car will cha
se"
210 PRINT"a man. Press t
he"
220 PRINT"spacebar to fi
re a"
230 PRINT"missile at the
 car.";
240 '
250 FOR D=1 TO 500:NEXT
D
260 '
270 CLS
280 '
290 XM=INT(RND(1)*15+3)
300 PE=INT(RND(1)*5+1)
310 YM=3
320 FOR XC=18TO0 STEP-1
330 LOCATE XC/2,0:PRINTC
HR$(154);
340 LOCATE XC,0:PRINTCHR
$(152);
350 A$=INKEY$
360 LOCATE XM,YM:PRINT"
";
370 IF YM<3 THEN YM=YM-1
380 IF YM<0 THEN 470
390 IF A$<>"" THEN YM=2
400 LOCATE XM,YM
405 PRINTCHR$(151);
410 SOUND XC,PE
420 IF YM<>0 THEN 430
425 IF XC=XM THEN 570
430 NEXT XC
440 '
450 'miss
460 '
470 SOUND 0,20
480 CLS
490 LOCATE 5,2,0:PRINT"Y
ou missed!"
500 FOR I=12 TO 1 STEP-1
510 SOUND I,1
520 NEXT I
530 GOTO 250
540 '
550 'Hit
560 '
570 LOCATE 2,2,0:PRINT"Y
ou hit it!"
580 FOR I=1 TO 3
590 SOUND 2,3
600 NEXT I
610 GOTO 250
```



values are available in programs.

As with the functions, the expected numeric operators are all present. Boolean operators are also available, including the seldom seen implication (IMP) and equivalence (EQV) in addition to the more common AND, OR, NOT, and XOR.

The HX-20 has no calculator mode built in, per se. However, Basic has an immediate mode so that entering a command such as PRINT 3.25/.005+2.4 will cause the calculations to be performed and the answer to be displayed. Furthermore PRINT can by typed as a question mark to minimize keystrokes.

The HX-20 can perform calculations in both single- and double-precision (16 digits) accuracy. Variables and data can be decimal, hex, and octal(!) integers.

All the usual, expected statements and commands are in EBasic along with a few notable additions. In particular, an INPUT$ statement is included; it reads a specific number of characters from the keyboard or a file and waits until they are all delivered before proceeding.

Again, the file handling statements are pretty much as one would expect, but with a few interesting additions. The function LOF returns the length of an open file in bytes. Each file is defined in the form "Device name: file name" with file name being optional. As on DEC's RSTS-11 (Resource Sharing, Time Sharing) system, a file can be easily directed to another device by simply changing the name. Recognized devices include the keyboard, display, internal and external cassette recorders, RS-232 ports, and internal printer. We are told that the ROM software packs will be recognized also.

All the usual, expected statements and commands are in EBasic along with a few notable additions.

Files may be saved in either ASCII or a compressed binary format. The files mentioned above (tape, printer, display, etc.) are all sequential files. However, files in the RAM memory are random access. In addition to allocating string space, the CLEAR command can be used to set aside protected file space. Once allocated, individual files can be defined in this cleared area using DEFFIL which defines record length and number of bytes from the beginning of the first record. All types of data may be mixed in a record.

It would seem that RAM memory files would be quite useful for storing tables of constants or conversion factors that must be frequently referenced or for storing data to be passed from one program to another. This sort of capability encourages structured programming since intermediate results are easily set aside for use in the next set of steps.

The graphics commands are adequate if not extensive. PSET lights up one pixel, PRESET turns it off, and LINE draws a line between two defined points. POINT is a cousin of PEEK in that it tells if a particular pixel is lit up.

In summary, EBasic is sophisticated and well suited to the capabilities of the HX-20. We expressed disappointment in the Basic implementation for the DEC Rainbow 100 in that it did not take full advantage of the hardware; this Basic is quite the opposite. As would be expected, the Basic tends to be oriented most strongly toward business, engineering, and educational applications. Graphics games enthusiasts should look elsewhere.

Monitor and Machine Language

When you switch on the HX-20, the screen always shows the menu, the first three lines of which are always the same, namely:

CTRL/@ Initialize
1 MONITOR
2 BASIC

The first line essentially says that pressing the control and ampersand keys together will initialize the computer. This clears all memory contents and the system clock. It also sets default values for memory size, and file space, and reassigns the five function keys to the ten preset functions described above. Thus control/@ is a global and somewhat dangerous command.

According to the rather sparse documentation we had, more of which later, the monitor is interrelated with "assembly language" programming. Unfortunately the documentation provided no instructions whatsoever for writing machine or assembly language programs. The closest we came to doing anything in assembly language was to use the MEMSET command to allocate space for programs below the space for Basic programs.

If the processor is truly compatible with the 6800, then one could presum-

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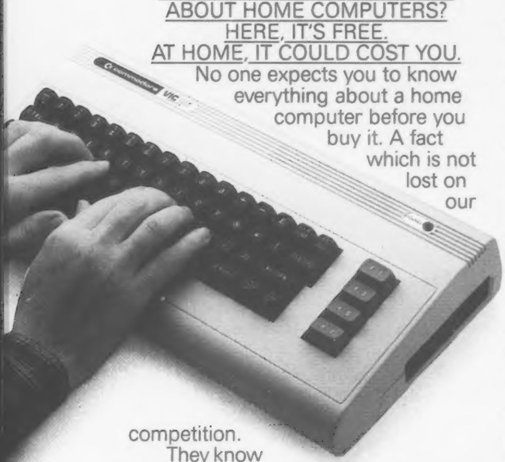

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Peripheral Expansion System	Not Necessary	$249.95	Not Necessary
Disk Drive	$399.00	399.95	599.95
Disk Controller Card	Included	249.95	Included
Modem	109.95	224.95	199.95
Modem Interface	Included	174.95	219.95
TOTAL	$508.95	$1299.75	$1079.80

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COMPUTER FEATURES	VIC 20	TI 99/4A	ATARI 400
Typewriter Keys	Yes	Yes	No
Typewriter Feel	Yes	No	No
Color Control Keys	Yes	No	No
Graphics on Keys	Yes	No	No
Reverse Letters	Yes	No	Yes
Programmable Function Keys	Yes	No	No
Works with TV or Monitor	Yes	Yes	No
True Lower Case Letters	Yes	No	Yes
DISK FEATURES			
Capacity	170K	90K	88K

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Barcode reader	n/a

ably use one of the many books on 6800 programming to write code for the HX-20. I am not sufficiently versed in 6800 programming, or any machine language programming for that matter, to experiment with this.

The monitor commands allow dumping and changing blocks of memory and saving binary files on tape. The monitor also gives you the ability to change the contents of the various processor registers and set breakpoints. One nifty command is K which allows you to set up a "boot" program which is automatically executed when the HX-20 is switched on. Hence, you could have the machine come up in Basic, a word processing program, or anything else you wanted.

With the standard 16K memory, the amount of memory normally allocated to Basic programs is 12,891 bytes; another 500 bytes are allocated to variable and string file space; the balance is used by the system. Adding the 16K expansion memory pack increases the available program space to 29,275 bytes.

Other Software Packages

At the time of our evaluation, none of the other software packages was available. But at a recent conference, the Epson people were showing a pre-release version of a word processing package called Correspondent and mailing list program, MList. Both are to be made available "soon" on ROM packs.

Other software packages in the works include a spreadsheet program, Epsoncalc; a database management package called Personal Office, and a sales order package which lets orders be recorded, issues receipts, and downloads order files to a host computer at the home office.

Also in the works is a program writer type of package, DIY, along the lines of *The Last One* which is said to allow users to write software in plain English. We are somewhat skeptical about these type of packages, but this one could turn out to be better.

Documentation

At a recent conference, I held up the HX-20 in one hand and two fat three-ring binders of documentation in the other. I remarked that this is the first computer for which the documentation was larger and weighed more than the computer itself. Actually, that is not quite fair as the documentation I had was preliminary, double spaced and reproduced on only one side of the sheet. Presumably, when it is typeset and printed it will be considerably more compact.

I had only the documentation for the Basic language which, as mentioned earlier, was produced by Ski Soft. The manual was an excellent combination of tutorial and reference material. Epson has a well-deserved reputation for user-friendly documentation, and this was no exception. Unfortunately, the manual lacked an index, a curious omission.

Unfortunately, several letters and six phone calls to the Epson folks in California failed to elicit a copy of the technical manual. Dick Pountain at *PCW* wangled a copy from the British distributor and he reports that it, like the Basic manual, is quite good.

Dick reports that "the technical manual is remarkably detailed, going through all the hardware down to the signal and timing level and ending with maintenance and repair instructions which are intended for the dealer and repair shop."

> ***This is the first computer for which the documentation is larger and weighs more than the computer itself.***

In Summary

The HX-20 is a quantum leap forward in putting the power and capability of a full computer in a compact package. It is aimed squarely at business and educational users, both those willing to do their own programming as well as those seeking a turnkey machine. The planned software releases on ROM pack will enhance the usefulness of the machine substantially.

Personally, I believe the version that will have the widest acceptance is the one with the built-in microcassette recorder. Although using an external tape cassette recorder saves a few dollars on the purchase price, it reduces portability and does not permit the use of the excellent fast wind and seek capabilities. For many purposes, the built-in microcassette will obviate the need for a floppy disk drive (not expected out until well into 1983).

The quality of the full-stroke keyboard is excellent, although because it is actually part of a printed circuit board, there is a noticeable "give" during fast typing. Strengthening or supporting this board would be a welcome modification. Nevertheless, it is certainly suitable for light word processing and I look forward to the introduction of the ROM pack.

For working on a plane, train, or away from the office the HX-20 is unrivaled. How often I have dreamed of having a spreadsheet or word processing computer with me on cross country or transatlantic plane trips! It would seem that the HX-20 is the answer to these dreams.

The barcode reader is an interesting add-on that could open up a huge market for stock control and sales order applications.

Given the immense marketing clout of the Epson organization, I expect the HX-20 to occupy a significant place in the computer market before too long. This suggests that many third party vendors will rush in to produce software packages which should contribute to the desirability and acceptance of the computer.

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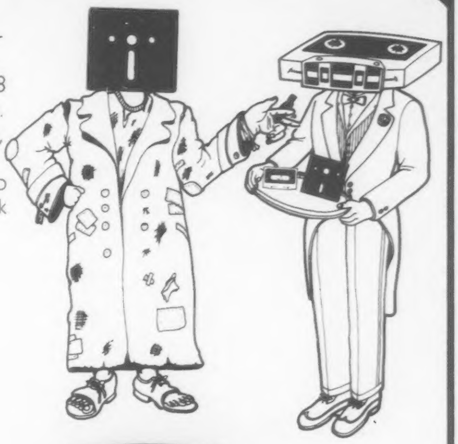

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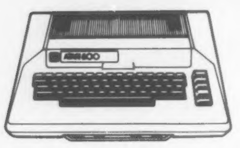

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evaluation

The Apple IIe Personal Computer

A First Hand Examination

Danny Goodman

It was a November week of visits to computer and other high-tech companies in California's Silicon Valley, a rich territory noteworthy enough to qualify for recent *Sixty Minutes* and *National Geographic* treatments. Highway 101 is the standard bus that connects the sprawling communities around San Jose, where the electronics industry knows little of recession. In fact, practically every office or factory visited fell into one of two categories. Either they had just moved into larger facilities, or expansion into a new building or wing was underway.

Veil of Secrecy

My job for the morning of the twelfth was to see firsthand one of the best kept secrets of the computer industry: the specifications and features of a machine that would have the onerous responsibility of becoming the successor to the world famous Apple II Plus. All I knew about it was its name: Apple IIe.

Directions I was given over the phone led me to a seven story Cupertino office building still undergoing final construction and outfitting for its first round of tenants. Fortunately, the directions also included the floor on which the meeting was to occur, because the sparsely-filled building directory did not list Apple Computer, nor anything else on that floor. "What better way to keep a secret than to have offices on an unlisted floor," I muttered to myself.

When the elevator door opened, however, I was unmistakably in the lobby of an Apple Computer facility. Literature and retail displays boasting the merits of the Apple II Plus and Apple III added color to the predominantly grey color scheme.

> **An outgrowth of the flexibility of the II has been an enormous following of software developers.**

Our meeting was delayed a few minutes at the bidding of a Murphy's Law application ("If anything can possibly go wrong, it will."). The room in which the new computer and its predecessor had been set up and checked out the night before suddenly had no power at all. Such are the mysteries of working in a new facility. Critics of the dependence of a company or professional on a computer should note this incident and conclude that we are instead dependent on more fundamental needs. Electricity, for example.

Before long, I met Paul Dali, general manager of Apple's Personal Computer Systems Division. Together we entered a small meeting room with what at first looked like two Apple II Plus systems—both with tops removed—set up along the windows. But no, the two machines were decidedly different.

Apple II Facts and Figures

As background to the development of the new model, Paul analyzed the success of the Apple II. He noted that over the years Apple has been pursuing five distinct markets with the Apple II. First is the office, where a computer is used as a productivity tool in basic tasks such as word processing, database management, communications, and the like. Such productivity applications represent Apple's biggest market.

Related to the office is the very small business market, a difference denoted not necessarily by company size (although generally with sales under $20 million) but by specific applications for the business—vertical systems, Apple

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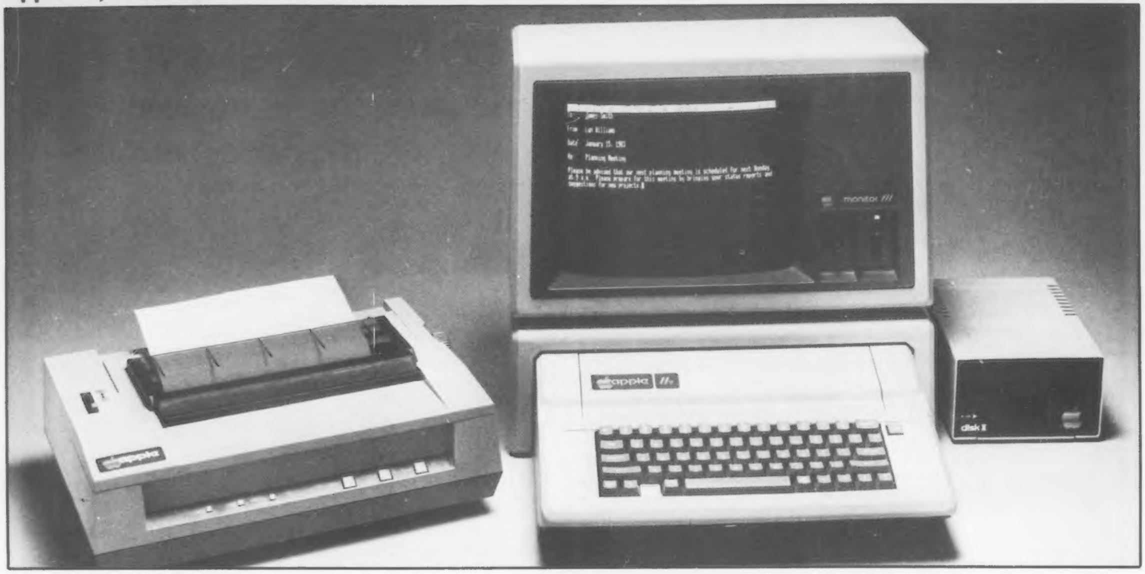

calls them. Into this category fall uses such as accounting, payroll, credit union systems, and banking systems. He estimated that today there are about 250,000 Apple IIs in the office, and that most of these were brought into the office initially by an individual who spent his or her own money on the unit.

A third market—and still quite a large one at that—is the educational one. Twenty-five percent of Apple's sales are to the educational market—I would never have guessed such a large figure. The balance of Apple IIs go to the scientific/industrial and family/consumer markets.

Addressing so many and such diverse markets should be a nightmare for any kind of product. But the Apple II has a built-in feature that lets it meet needs in all these areas: expansion slots. The unit is an open system that lets the user put in anything that transforms the basic machine into a special purpose computer. Paul summarized the Apple II this way, "Flexibility is and always will be the single biggest reason why the machine sells. It is so adaptable."

An outgrowth of the flexibility of the II has been an enormous following of software developers. Apple counts well over 10,000 programs available for the II. Paul maintained that the installed base of the II is so big that it represents a market too big for programmers to overlook. "We can't stop the software development momentum. Every time someone writes more software, they'll tend to write for the Apple also."

Although the Apple II has gone through some revisions during its lifetime (replacing 4K RAM chips with 16K chips, improving color graphics, and meeting FCC radio frequency requirements), the basic features have remained essentially unchanged. The mother board has seven expansion slots. The display output is a 40-column width format and characters are shown in upper case only. Finally, the Apple II has exhibited a good reliability record, according to an informal and totally unscientific dealer poll I have taken over the years.

Paul was quick to point out that despite its popularity, the Apple II Plus has several disadvantages. Lower case letter display is not standard. On-board memory (RAM) is limited to 48K. The teletype-like keyboard has a limited character set. The attachment of peripherals (printers, modems, game controllers, etc.) requires removing the top and plugging onto the appropriate circuit card. An 80-column display (particularly useful in professional applications) is a costly add-on. And, although some of these deficiencies could be corrected with add-ons, not all cards were compatible with one another.

A number of significant changes were made in the manufacturing process of the IIe as well.

(At this juncture, Paul and I were joined by Walt Broedner, who designed the insides of the new Apple, and Rick Rice, production coordinator. Walt brought along a chip-filled circuit board, and Rick had a complete computer as props for their parts of the presentation. More about those later.)

Enter Apple IIe

Paul then went on to formally introduce the newest Apple, the Apple IIe, "e" for "enhanced." And enhanced it is. While the changes in the IIe will be more apparent to current Apple followers, the end product for the first-time shopper is a machine with many built-in features.

To the uncritical eye, the IIe cabinet looks like a clone of the II. The differences in appearance lie in the keyboard (see below) and the logo. The proper designation is Apple //e (as in Apple ///), and the logo is now at the lower left corner of the removable top instead of at the bottom center.

The basic ("vanilla," Paul called it) IIe will be sold with a minimum of 64K RAM, expandable to 128K with an additional memory board. That's getting the IIe up to where the Apple III starts taking over for heavy-duty business applications.

Applesoft Basic is no longer on a separate language board that takes up an expansion slot. It is now resident on the motherboard as part of a new custom integrated circuit.

Upper and lower case characters are both standard. Display characters on the monitor are composed in a 5x7 picture element array within a 7x9 field, allowing for lower case descenders.

The 63-key keyboard in many ways resembles that of the Apple III (without numeric keypad). The full 128-character

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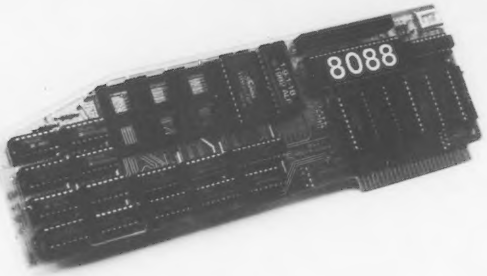

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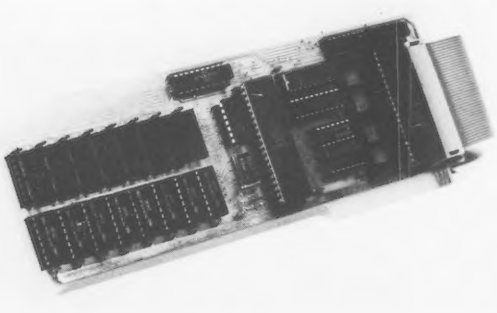

THE 8087 NUMERIC DATA PROCESSOR

The AD128K Memory Card features a socket for the Intel 8087 Numeric Data Processor. The 8087's 80-bit internal format gives 18 digits of accuracy (Applesoft has only 9). Its speed is equally impressive: it multiplies two 80-bit floating-point numbers faster than the Apple runs 10 machine codes!

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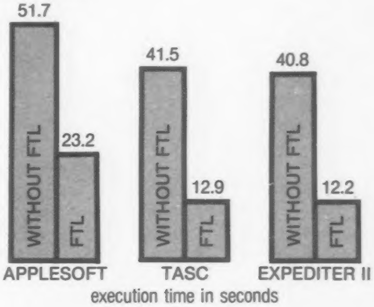
```
10 PRINT "2 3 ";
20 FOR B = 5 TO
   1000 STEP 2
30 FOR C = 3 TO
   SQR (B) STEP 2
40 IF B/C = INT
   (B/C) THEN 70
50 NEXT
60 PRINT B;" ";
70 NEXT B
```

Program to compute prime numbers from 2 to 1000.



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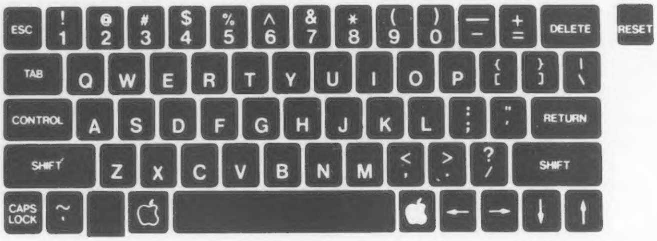
ESC ! 1 @ 2 # 3 $ 4 % 5 ^ 6 & 7 * 8 (9) 0 — − + = DELETE
RESET
TAB Q W E R T Y U I O P { [}] | \
CONTROL A S D F G H J K L : ; " ' RETURN
SHIFT Z X C V B N M < , > . ? / SHIFT
CAPS LOCK ~ ` ← → ↓ ↑

Apple IIe Keyboard

ASCII set is on the keyboard. All keys also have auto repeat (holding a key down causes the character to repeat—especially helpful in fast cursor movement). The key layout of the IIe includes four cursor keys (all in a row at the lower right) and Open Apple/Solid Apple limited function keys (on each side of the space bar). A raised dot on the D, K, and one cursor key help touch typists keep on track.

The RESET key has been moved to the far upper right of the keyboard and an accidental press won't clear out your machine and an hour's keyboard input. That operation now requires a deliberate, three-key sequence (simultaneously pressing CTRL-OPEN APPLE-RESET). The new reset procedure is also aimed at saving the power switch, one of the biggest service problems on the II Plus.

The motherboard, although still presenting a 40-column display as standard, is equipped to accept a new, "inexpensive" 80-column card that has only five integrated circuits. No price for the card was available, but it was to compare favorably with II Plus 80-column cards which cost in excess of $300. The Apple 80-column card fits into an auxiliary connector located out of the way from the seven slots, but is still equivalent to slot 3. The decision to offer 80 columns as an option was based on cost-conscious education and consumer market needs for only 40-column displays. With the IIe 80-column board in place, the user has mixed screen modes available. There can be graphics on the upper screen and either 40- or 80-column text on the bottom four lines.

How will the hundreds of companies currently selling Apple supporting products respond to the new unit?

Low resolution color graphics are 40x48 elements in 16 colors. With 64K RAM installed, optimum color graphics resolution is 290x192 (six colors). But this increases to a 560x192 array if the full complement of 128K RAM is installed.

There are significant improvements in the back panel, or "backplane," as it is known. The panel is now metal, with several holes precut to accept female connectors attached by cable to the accessory cards installed in the expansion slots. There is room for up to four each of the following D-connectors: 25, 19, and 9-pin. The 9-pin holes also accept DIN-type connectors, popular in Europe.

Additionally, the game controller connector has been permanently installed on the backplane, yet the old connector has been left inside the cabinet (a small clock card was installed in the IIe for our demonstration). The use of panel connectors will make switching peripherals a much easier task. Incidentally, the design better seals the unit against RF leakage. All Apple-manufactured cards will have connectors and short cables, as well as an adapter that will let II Plus owners slide the connector into their plastic backplane slot.

Hidden Improvements

There are many changes, too, that may not be apparent to the user, but are no less important.

The microprocessor is a newer version of the older 8-bit 6502. The chip is called the 6502A which can operate at a speed of 2 megaHertz (mHz.), but in the IIe is kept at the old speed of 1.8 mHz.

A number of signifcant changes were made in the manufacturing process of the IIe as well. In the Apple II Plus de-

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NEW CP/M 3.0 - Digital Research

CP/M 3.0 is Digital Research's latest version of the industry standard disk operating system. It features many performance improvements such as intelligent record buffering, improved directory handling, "HELP" facility, time/date stamping of files and many more improvements. AND A TREMENDOUS INCREASE IN SPEED !!!, it is fully CP/M 2.2 compatible and requires no changes to your existing application software. Available only to Versafloppy II owners with SBC-200 CPU's

SFC-55009057F	*CP/M 3.0 8" with manuals*	**$200.00**
SFC-55009057D	*CP/M 3.0 manual set*	**$30.00**

Apple II Accessories

APPLE DISK DRIVE - Fourth Dimension

Totally Apple compatible, 143,360 bytes per drive on DOS 3.3, half-track capability - reads all Apple software, plugs right in to Apple controller as second drive, DOS 3.3, 3.2.1, Pascal, & CP/M compatible.

MSM-123200	*40 Track add on Apple drive*	**$289.95**
MSM-123200	*Controller with free DOS 3.3*	**$99.95**

16K RAM CARD - for Apple II

Expand your Apple II to 64K, use as language card, full 1 year warranty. Why spend $175.00 ?

MEX-16700A	*Save over $100.00*	**$69.95**

Z-80 CPU CARD - for Apple II

Two computers in one, Z-80 & 6502, more than doubles the power and potential of your Apple, includes Z-80 CPU card CP/M and complete manual set.

CPX-62800A	*A & T with software*	**$249.95**

APPLE-CAT - Novation

Software selectable 1200 or 300 baud, direct connect, auto-answer/auto-dial, auxiliary 3-wire RS232C serial port for printer.

IOM-5232A	*Save $50.00!!!*	**$325.95**

8" DISK CONTROLLER - Vista

New from Vista Computer, single or double sided, single or double density, compatible with DOS 3.2/3.3, Pascal, & CP/M 2.2, Shugart & Qume compatible

IOD-2700A	*A & T*	**$499.95**

2 MEGABYTES for Apple II

Complete package includes: Two 8" double-density disk drives, Vista double-density 8" disk controller, cabinet, power supply, & cables, DOS 3.2/3.3, CP/M 2.2, & Pascal compatible.

1 MegaByte Package	*Kit*	**$1495.00**
1 MegaByte Package	*A & T*	**$1695.00**
2 MegaByte Package	*Kit*	**$1795.00**
2 MegaByte Package	*A & T*	**$1995.95**

VISION 80 - Vista Computer

80 column x 24 line video card for Apple II, 128 ASCII characters, upper and lower case, 9 x 10 dot matrix with 3 dot descenders, standard data media terminal control codes, CP/M Pascal & Fortran compatible, 50/60 Hz

IOV-2400A	*Vista Vision 80*	**$299.95**

CPS MULTICARD - Mtn. Computer

Three cards in one! Real time clock/calendar, serial interface, & parallel interface - all on one card.

IOX-2300A	*A & T*	**$179.95**

Power Strips

ISOBAR - GSC

Isolates & protects your valuable equipment from high voltage spikes & AC line noise, inductive isolated ground, 15 amp circuit breaker, U.L. listed

EME-115103	*3 socket*	**$39.50**
EME-115105	*4 socket*	**$49.50**
EME-115100	*8 socket*	**$54.50**
EME-115110	*9 socket rackmount*	**$74.50**

Single Board Computer

SUPERQUAD - Adv. Micro Digital

Single board, standard size S-100 computer system, 4 MHz Z-80A, single or double density disk controller for 5¼" or 8" drives, 64K RAM, extended addressing, up to 4K of EPROM, 2 serial & 2 parallel I/O ports, real time interrupt clock, CP/M compatible.

CPC-30800A	*A & T*	**$724.95**
IOX-4232A	*Serial I/O adapter*	**$29.95**

Z-80 STARTER KIT - SD Systems

Complete Z-80 microcomputer with RAM, ROM, I/O, keyboard, display, kludge area, manual, & workbook.

CPS-30100K	*Kit with workbook*	**$299.95**
CPS-30100A	*A & T with workbook*	**$469.95**

AIM-65 - Rockwell International

Complete 6502 microcomputer with alphanumeric display, printer, keyboard, & instruction manual.

CPK-50165A	*1K AIM-65*	**$424.95**
CPK-50465A	*4K AIM-65*	**$474.95**
SFK-74600008E	*8K Basic ROM*	**$64.95**
SFK-64600004E	*4K assembler ROM*	**$43.95**
SFK-74600020E	*PL/65 ROM*	**$84.95**
SFK-74600010E	*Forth ROM*	**$64.95**
SFK-74600030E	*Instant Pascal*	**$99.95**
PSX-030A	*Power supply*	**$64.95**
ENX-000002	*Enclosure*	**$54.95**

SPECIAL PACKAGE

4K AIM-65, 8K Basic, power supply, & enclosure

Special Package Price	**$649.95**

S-100 EPROM Boards

PROM-100 - SD Systems

2708, 2716, 2732 EPROM programmer with software.

MEM-99520K	*Kit with software*	**$189.95**
MEM-99520A	*A & T with software*	**$249.95**

PB-1 - SSM Microcomputer

2708, 2716 EPROM board with on-board programmer.

MEM-99510K	*Kit with manual*	**$154.95**
MEM-99510A	*A & T with manual*	**$219.95**

EPROM BOARD - Jade

16K or 32K uses 2708 or 2716 EPROMs, 1K boundary.

MEM-16230K	*Kit w/o EPROMs*	**$79.95**
MEM-16230A	*A & T w/o EPROMs*	**$119.95**

S-100 Video Boards

SPECTRUM COLOR - CompuPro

Full-function color graphics board, up to 8 colors, 256 x 192 graphics, parallel I/O port, 8K RAM.

IOV-1870A	*A & T*	**$348.95**
IOV-1870C	*CSC*	**$398.95**

MICROANGELO - Scion

Ultra-high-resolution 512 x 480, 256 color or black & white S-100 video board

IOV-1500A	*A & T*	**$799.95**

S-100 MotherBoards

ISO-BUS - Jade

Silent, simple, and on sale - a better motherboard

	6 Slot (5¼" x 8⅝")	
MBS-061B	*Bare board*	**$22.95**
MBS-061K	*Kit*	**$39.95**
MBS-061A	*A & T*	**$69.95**
	12 Slot (9¾" x 8⅝")	
MBS-121B	*Bare board*	**$34.95**
MBS-121K	*Kit*	**$69.95**
MBS-121A	*A & T*	**$109.95**
	18 Slot (14½" x 8⅝")	
MBS-181B	*Bare board*	**$54.95**
MBS-181K	*Kit*	**$99.95**
MBS-181A	*A & T*	**$149.95**

ACTIVE TERMINATOR - CompuPro

A true mother's helper.

TSX-100A	*A & T*	**$59.45**

Prices may be slightly higher at our retail locations. Please call the store nearest you for local price and availability.

Free CP/M 3.0* !!!

S-100 CPU Boards

8086/8087 - CompuPro

16 bit, 8 or 10 MHz 8086 CPU with provisions for 8087 & 80130.

CPU-70520A	*8 MHz 8086 A & T*	**$624.95**
CPU-70520C	*8 MHz 8086 CSC*	**$764.95**
CPU-70530A	*with 8087 A & T*	**$1224.95**
CPU-70530C	*with 8087 CSC*	**$1455.95**

8085/8088 - CompuPro

Both 8 & 16 bit CPUs, standard 8 bit S-100 bus, up to 8 MHz, accesses 16 Megabytes of memory.

CPU-20510A	*6 MHz A & T*	**$398.95**
CPU-20510C	*6/8 MHz CSC*	**$497.95**

CPU-Z - CompuPro

2/4 MHz Z80A CPU, 24 bit addressing.

CPU-30500A	*2/4 MHz A & T*	**$279.95**
CPU-30500C	*3/6 MHz CSC*	**$374.95**

SBC-200 - SD Systems

4 MHz Z-80A CPU with serial & parallel I/O, 1K RAM, 8K ROM space, monitor PROM included.

CPC-30200A	*A & T*	**$329.95**

THE BIG Z - Jade

2 or 4 MHz switchable Z-80 CPU board with serial I/O, accomodates 2708, 2716, or 2732 EPROM, baud rates from 75 to 9600.

CPU-30201B	*Bare board w/manual*	**$35.00**
CPU-30201K	*Kit with manual*	**$149.95**
CPU-30210A	*A & T with manual*	**$199.95**

CB-2 - SSM Microcomputer

2 or 4 MHz Z-80 CPU board with provision for up to 8K of ROM or 4K of RAM on board, extended addressing, IEEE S-100, front panel compatible.

CPU-30300K	*Kit with manual*	**$229.95**
CPU-30300A	*A & T with manual*	**$274.95**

2810 Z-80 CPU - C.C.S.

2 or 4 MHZ Z-80 CPU with serial I/O port & on-board monitor PROM, front panel compatible.

CPU-30400A	*A & T with PROM*	**$289.95**

2820 Z-80 DMA CPU - C.C.S.

4 MHz Z-80 CPU board with 2 serial I/O ports & Centronics parallel I/O port, separate data & status ports, DMA daisy chain compatible.

CPU-30420A	*A & T with manual*	**$569.95**

S-100 Disk Controllers

DISK 1 - CompuPro

8" or 5¼" DMA disk controller, single or double density, single or double sided, 10 MHz.

IOD-1810A	*A & T*	**$449.95**
IOD-1810C	*CSC*	**$554.95**
SFC-52506580F	*8" CP/M 2.2 for Z-80*	**$174.95**
SFC-52506586F	*8" CP/M 2.2 for 8086*	**$299.95**
SFO-54158000F	*Oasis single user*	**$499.95**
SFO-54158002F	*Oasis multi-user*	**$849.95**

VERSAFLOPPY II - SD Systems

Double density disk controller for any combination of 5¼" and 8" single or double sided, analog phase-locked loop data separator, vectored interrupts, CP/M 2.2 & Oasis compatible, control/diagnostic software PROM included.

IOD-1160A	*A & T with PROM*	**$359.95**
SFC-55009047F	*CP/M 2.2 with VF II*	**$99.95**

2242 DISK CONTROLLER - C.C.S.

5¼" or 8" double density disk controller with on-board boot loader ROM, free CP/M 2.2 & manual set.

IOD-1300A	*A & T with CP/M 2.2*	**$399.95**

DOUBLE D - Jade

High reliablity double density disk controller with on-board Z-80A, auxiliary printer port, IEEE S-100, can function in multi-user interrupt driven bus.

IOD-1200B	*Bare board & hdwr man*	**$59.95**
IOD-1200K	*Kit w/hdwr & sftwr man*	**$299.95**
IOD-1200A	*A & T w/hdwr & sftwr man*	**$325.95**
SFC-59002001F	*CP/M 2.2 with Double D*	**$99.95**

S-100 Memory Boards

256K RAMDISK - SD Systems

ExpandoRAM III expandable from 64K to 256K using 64K x 1 RAM chips, compatible with CP/M, MP/M, Oasis, Cromemco, & most other Z-80 based systems, functions as ultra-high speed disk drive when used with optional RAMDISK software.

MEM-65064A	*64K A & T*	**$474.95**
MEM-65128A	*128K A & T*	**$574.95**
MEM-65192A	*192K A & T*	**$674.95**
MEM-65256A	*256K A & T*	**$774.95**
SFC-55009000F	*RAMDISK sftwr CP/M 2.2*	**$44.95**
SFC-55009000F	*RAMDISK with EXRAM III*	**$24.95**

128K RAM 21 - CompuPro

128K x 8 bit or 64K x 16 bit static RAM board, 12 MHz, 24 bit addressing.

MEM-12810A	*A & T*	**$1609.95**
MEM-12810C	*CSC*	**$1794.95**

64K RAM 17 - CompuPro

64K CMOS static RAM board, 10 MHz, low power less than 4 watts, DMA compatible, 24 bit addressing.

MEM-64180A	*64K A & T*	**$549.95**
MEM-64180C	*64K CSC*	**$698.95**

64K RAM 16 - CompuPro

32K x 16 bit or 64K x 8 bit low power static RAM board, 10 MHz, 24 bit addressing.

MEM-32180A	*RAM 16 A & T*	**$598.95**
MEM-32180C	*RAM 16 CSC*	**$698.95**

64K STATIC RAM - SSM

IEEE 696/S-100 standard, up to 6MHz/8 Bit, 12MHz/16 Bit, 24 Bit extended addressing, disable-able in 2K increments

MEM-64300A	*A & T*	**$499.95**

64K STATIC RAM - Mem Merchant

64K static S-100 RAM card, 4 to 16K banks up to 8 MHz.

MEM-64400A	*64K A & T*	**$499.95**

64K STATIC RAM - Jade

Uses new 2K x 8 static RAMs, fully supports IEEE 696 24 bit extended addressing, 200ns RAMs, lower 32K or entire board phantomable, 2716 EPROMs may be subbed for RAMs, any 2K segment of upper 8K may be disabled, low power typically less than 500ma.

MEM-99152B	*Bare board*	**$49.95**
MEM-99152K	*Kit less RAM*	**$99.95**
MEM-32152K	*32K kit*	**$199.95**
MEM-56152K	*56K kit*	**$289.95**
MEM-64152K	*64K kit*	**$299.95**
Assembled & Tested		**add $50.00**

2066 64K RAM - C.C.S.

64K RAM board with bank and block select switching functions for Cromemeco Cromix & Alpha Micro.

MEM-64566A	*64K A & T*	**$424.95**

64K EXPANDORAM II - SD Systems

Expandable RAM board from 16K to 64K using 4116 RAM chips.

MEM-16630A	*16K A & T*	**$344.95**
MEM-32631A	*32K A & T*	**$364.95**
MEM-48632A	*48K A & T*	**$384.95**
MEM-64633A	*64K A & T*	**$399.95**

MEMORY BANK - Jade

4 MHz S-100 bank selectable expandable to 64K.

MEM-99730B	*Bare board w/manual*	**$49.95**
MEM-99730K	*Kit with no RAM*	**$179.95**
MEM-32731K	*32K kit*	**$199.95**
MEM-64733K	*64K kit*	**$249.95**
Assembled & Tested		**add $50.00**

16K STATIC RAM - Mem Merchant

4MHz lo-power static RAM board, IEEE S-100, bank selectable, addressable in 4K blocks, disable-able in 1K segments extended addressing.

MEM-16171A	*16K A & T*	**$149.95**

Free CP/M 3.0 Offer

THREE BOARD SET - SD Systems

S-100 board set with 4 MHz Z-80A, 64K of RAM expandable to 256K, serial and parallel I/O ports, double-density disk controller for 5¼" and 8" disk drives, new and improved CP/M 3.0 manual set, system monitor, control and diagnostic software. Includes SD Systems SBC-200, 64K ExpandoRAM III, Versafloppy II, and FREE CP/M 3.0 - all boards are assembled & tested.

64K Board Set with FREE CP/M 3.0	**$1195.00**
256K Board Set with FREE CP/M 3.0	**$1395.00**

S-100 I/O Boards

SYSTEM SUPPORT 1 - CompuPro

Real time clock, three 16 bit interval timers, dual interrupt controllers(15 levels), up to 4K EPROM/RAM, RS-232C serial channel, provision for 9511A/9512 math chip.

IOX-1850A	*SS1 A & T*	**$359.95**
IOX-1850C	*SS1 CSC*	**$459.95**
IOX-1855A	*with 9511 A & T*	**$554.95**
IOX-1855C	*with 9511 CSC*	**$654.95**
IOX-1860A	*with 9512 A & T*	**$554.95**
IOX-1860C	*with 9512 CSC*	**$654.95**

INTERFACER 1 - CompuPro

2 serial I/O ports 50-19.2K baud.

IOI-1810A	*A & T*	**$218.95**
IOI-1810C	*CSC*	**$288.95**

INTERFACER 3 - CompuPro

5 or 8 channel serial I/O board for interrupt driven multi-user systems up to 250K baud.

IOI-1835A	*5 port A & T*	**$558.95**
IOI-1835C	*5 port CSC*	**$628.95**
IOI-1838A	*8 port A & T*	**$628.95**
IOI-1838C	*8 port CSC*	**$749.95**

INTERFACER 4 - CompuPro

3 serial, 1 parallel, 1 Centronics parallel.

IOI-1840A	*A & T*	**$314.95**
IOI-1840C	*CSC*	**$414.95**

MPX - CompuPro

Multi-user I/O multiplexer & interrupt controller with on-board 8085A-2 CPU & 4K or 16K of RAM.

IOI-1875A	*4K MPX A & T*	**$444.95**
IOI-1875C	*4K MPX CSC*	**$534.95**
IOI-1880A	*16K MPX A & T*	**$584.95**
IOI-1880C	*16K MPX CSC*	**$674.95**

I/O-8 - SSM Microcomputer

Eight software programmable serial I/O ports, 110 -19.2K Baud, ideal for multi-user systems

IOI-1018A	*A & T*	**$469.95**

I/O-5 - SSM Microcomputer

Two serial & 3 parallel I/O ports, 110-19.2K Baud

IOI-1015A	*A & T*	**$289.95**

MPC-4 - SD Systems

Intelligent 4-port serial I/O card, on-board Z-80A, 2K RAM, 4K PROM area, on-board firmware, fully buffered, vectored interrupts, four CTC channels, add to SD Board set for powerful multi-user system

IOI-1504A	*A & T w/software*	**$495.00**

I/O-4 - SSM Microcomputer

2 serial I/O ports plus 2 parallel I/O ports.

IOI-1010B	*Bare board w/manual*	**$35.00**
IOI-1010K	*Kit with manual*	**$179.95**
IOI-1010A	*A & T with manual*	**$249.95**

2710 4 PORT SERIAL - C.C.S.

Four RS-232C serial I/O ports with full handshaking.

IOI-1060A	*A & T with manual*	**$319.95**

Prices may be slightly higher at our retail locations. Please call the store nearest you for local price and availability.

8" Double-Density Disk Drive $249

Save $500.00 Dual 8" Disk Drive Sub-System Kit - $695.00 Assembled & Tested - $795.00

Printers on Sale

NEW EPSONS with GRAFTRAX-plus

MX-80 MX-80FT MX-100

Available only from your local Jade Retail Store

Dallas, Woodland Hills,
Santa Ana, San Diego,
Sunnyvale, Los Angeles

Call the store near you for price or information.

INDUSTRIAL QUALITY PRINTERS - Okidata

We Can Beat Any Price... Call Us !!!

Microline 82A *80/132 column,* ***120 CPS****, 9 x 9 dot matrix, friction feed, pin feed, adjustable tractor feed (optional), handles 4 part forms up to 9.5" wide, rear & bottom feed, paper tear bar, 100% duty cycle/200,000,000 character print head, bi-directional/logic seeking,* ***both serial & parallel interfaces included****, front panel switch & program control of 10 different form lengths, uses inexpensive spool type ribbons, double width & condensed characters, true lower case descenders & graphics*

PRM-43082	*Friction & pin feed*	***Call***

Microline 83A *132/232 column, 120 CPS, forms up to 15" wide, removable tractor, plus all the features of the 82A.*

PRM-43083	*with FREE tractor*	***Call***

Microline 84 *132/232 column, Hi-speed 200 CPS, full dot graphics built in, plus all the features of the 83A.*

PRM-43084	*Centronics parallel*	***Call***
PRM-43085	*Serial with 2K buffer*	***Call***

PRA-27081	*Apple card*	**$39.95**
PRA-27082	*Apple cable*	**$19.95**
PRA-27087	*TRS-80 cable*	**$24.95**
PRA-43081	*2K hi speed serial card*	**$99.95**
PRA-43082	*Hi-res graphics ROMs 82A*	**$49.95**
PRA-43083	*Hi-graphics ROMs 83A*	**$49.95**
PRA-43088	*Tractor option for 82A*	**$49.95**
PRA-43080	*Extra ribbons pkg. of 2*	**$9.95**

8023 DOT MATRIX - NEC

100 CPS, proportional spacing, hi-resolution graphics, correspondence quality printing, bi-directional tractor & friction feed.

NEC-8023A	*8023 parallel*	**$499.95**
NEC-8023-01	*8023 ribbon*	**$11.95**

TP-1 LETTER QUALITY - SCM

12 CPS daisy wheel printer from Smith Corona.

PRD-45101	*Centronics parallel*	**$648.95**
PRD-45102	*RS-232C serial*	**$648.95**

LETTER QUALITY PRINTER - Jade

Uses standard daisy wheels and ribbon cartridges, 16 CPS bi-directional printing, semi-automatic paper loader (single sheet or fan fold), 10/12/15 pitch, up to 16" paper, built-in noise suppression cover.

PRD-11001	*Centronics parallel*	**$899.95**
PRD-11002	*RS-232C serial model*	**$969.95**
PRA-11000	*Tractor Option*	**$169.95**

KSR DAISY WHEEL - Anderson-Jacobson

Letter quality communications terminal/printer with full typewriter keyboard, 30 CPS Diablo print mechanism, RS-232 interface, includes free printer stand with deluxe casters, print wheel, ribbon, friction feed standard (tractor feed optional), factory refurbished with 30 day warranty, shipped freight collect.

PRD-99100	*AJ KSR printer*	**$995.00**
PRA-99200	*Tractor option*	**$150.00**

PRINTER PALS - F.M.J. Inc.

Desk top printer stand and continuous form paper holder.

PRA-99080	*for MX-80, MX-80FT, Oki 82A, NEC*	**$29.95**
PRA-99100	*for MX-100, Oki 83A & 84*	**$34.95**
PRA-99700	*for letter quality printers*	**$49.95**

5¼" Disk Drives

Tandon TM100-1 *single-sided double-density 48 TPI*	**MSM-551001**	$219.95 ea	2 for **$199.95 ea**
Shugart SA400L *single-sided double-density 40 track*	**MSM-104000**	$234.95 ea	2 for **$224.95 ea**
Shugart SA455 *half-size double-sided 48 TPI*	**MSM-104550**	$349.95 ea	2 for **$329.95 ea**
Shugart SA465 *half-size doule-sided 96 TPI*	**MSM-104650**	$399.95 ea	2 for **$379.95 ea**
Tandon TM100-2 *double-sided double-density 48 TPI*	**MSM-551002**	$294.95 ea	2 for **$269.95 ea**
Shugart SA450 *double-sided double-density 35 track*	**MSM-104500**	$349.95 ea	2 for **$329.95 ea**
Tandon TM100-3 *single-sided double-density 96 TPI*	**MSM-551003**	$294.95 ea	2 for **$269.95 ea**
Tandon TM100-4 *double-sided double-density 96 TPI*	**MSM-551004**	$394.95 ea	2 for **$374.95 ea**
MPI B-51 *single-sided double-density 40 track*	**MSM-155100**	$234.95 ea	2 for **$224.95 ea**
MPI B-52 *double-sided double-density 40 track*	**MSM-155200**	$344.95 ea	2 for **$334.95 ea**
MPI B-91 *single-sided double-density 77 track*	**MSM-155300**	$369.95 ea	2 for **$359.95 ea**
MPI B-92 *double-sided double-density 77 track*	**MSM-155400**	$469.95 ea	2 for **$459.95 ea**

5¼" Cabinets with Power Supply

END-000216	*Single cab w/power supply*	**$69.95**
END-000226	*Dual cab w/power supply*	**$94.95**

8" Disk Drives

Shugart SA810 *half-size single-sided double-density*	**MSF-108100**	$424.95 ea	2 for **$394.95 ea**
Shugart SA860 *half-size double-sided double-density*	**MSF-108600**	$574.95 ea	2 for **$549.95 ea**
Shugart SA801R *single-sided double-density*	**MSF-10801R**	$394.95 ea	2 for **$389.95 ea**
Shugart SA851R *double-sided double-density*	**MSF-10851R**	$554.95 ea	2 for **$529.95 ea**
Tandon TM848-1 *single-sided double-den thin-line*	**MSF-558481**	$379.95 ea	2 for **$369.95 ea**
Tandon TM848-2 *double-sided double-den thin-line*	**MSF-558482**	$494.95 ea	2 for **$484.95 ea**
Qume DT-8 *double-sided double-density*	**MSF-750080**	$524.95 ea	2 for **$498.95 ea**
Mitsubishi M2894-63 *double-sided double-density*	**MSF-289463**	$494.95 ea	2 for **$474.95 ea**
Siemens FDD 100-8 *single-sided double-density*	**MSF-201120**	$274.95 ea	2 for **$249.00 ea**

Dual Disk Sub-Systems

Disk Sub-Systems - Jade

Handsome metal cabinet with proportionally balanced air flow system, rugged dual drive power supply, power cable kit, power switch, line cord, fuse holder, cooling fan, never-mar rubber feet, all necessary hardware to mount 2-8" disk drives, power supply, and fan, does not include signal cable.

Dual 8" Sub-Assembly Cabinet

END-000420	*Bare cabinet*	**$59.95**
END-000421	*Cabinet kit*	**$225.00**
END-000431	*A & T*	**$359.95**

8" Sub-Systems - Single Sided, Double Density

END-000423	*Kit w/2 FD100-8Ds*	**$695.00**
END-000424	*A & T w/2 FD100-8Ds*	**$795.00**
END-000433	*Kit w/2 SA-801Rs*	**$999.95**
END-000434	*A & T w/2 SA-801Rs*	**$1195.00**

8" Sub-Systems - Double Sided, Double Density

END-000426	*Kit w/2 DT-8s*	**$1224.95**
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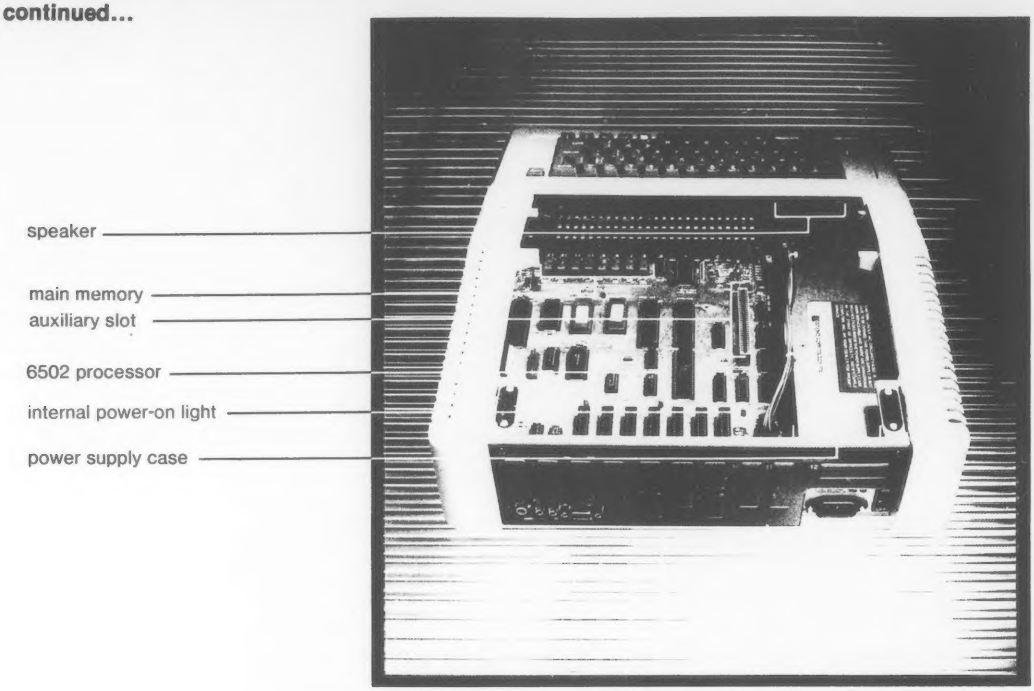

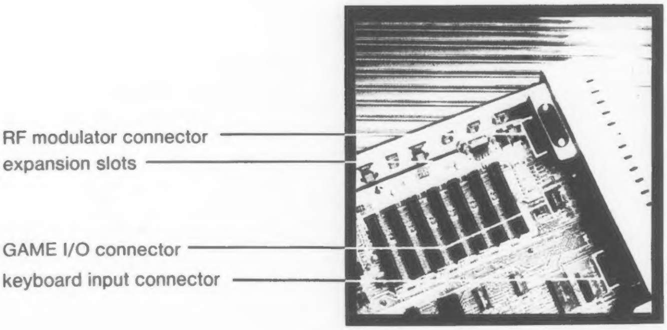

sign, the circuit boards were installed in the cabinet of the unit at an early stage of production. Burn-in testing took up much manufacturing space because finished computers could be tested only in their cabinets. If a bad unit was discovered, the case could be damaged in the handling, causing costly reworking of the unit.

The IIe, however, is just one circuit board for most of its production life. All parts are now insertable by machine. Burn-in testing is done on the circuit board in specially designed racks. Rick Rise pointed out the edge connectors that send signals from the testing rack through the computers and a red LED that is designed into the board to indicate that everything is working properly. Now, just the circuit board need be tested, in much less manufacturing space.

Goodbye, Mr. Chips

When looking at a II Plus and IIe side by side with their tops off, it is clear that a great deal of design energy went into reducing the number of integrated circuits for the IIe. For one thing, the designers have combined the old motherboard, separate keyboard circuit board, and Applesoft language card into a single motherboard. The 109 chips of the old system are now only 31. This 3-to-1 chip reduction is accomplished in several ways.

Solid state memory prices have dropped dramatically, opening the way for the inclusion of high capacity devices in place of many more lower capacity chips. For example, all of the 64-kilobyte RAM of the IIe is contained on eight 64-kilobit dynamic RAM chips. The keyboard character set is housed in a single 32-kilobit ROM chip. For international sale, Rick pointed out on the Swedish Apple IIe he had brought into the room, the IIe has a 64-kilobit ROM which holds both the American English character set and a completely separate character set for the language of the country in which the computer is sold. The international user can choose which set to use.

(The IIe will be released simultaneously in Europe as it is here in the U.S., one of the first such products to perform this feat.)

But one of the biggest chip-saving efforts went into two custom ICs designed by Walt Broedner. The story behind their development deserves retelling.

Custom Effort

With a set of ideal properties for a new Apple in mind, Walt set out to design a new Apple about two years ago. After no small effort, Walt delivered his designs of two chips to Synertek (a semiconductor manufacturer) for the production of samples. Walt's designs used two 40-pin integrated circuits (like the 6502 microprocessor) instead of a single 64-pin pack, because Apple didn't have the experience of working with such packages in production.

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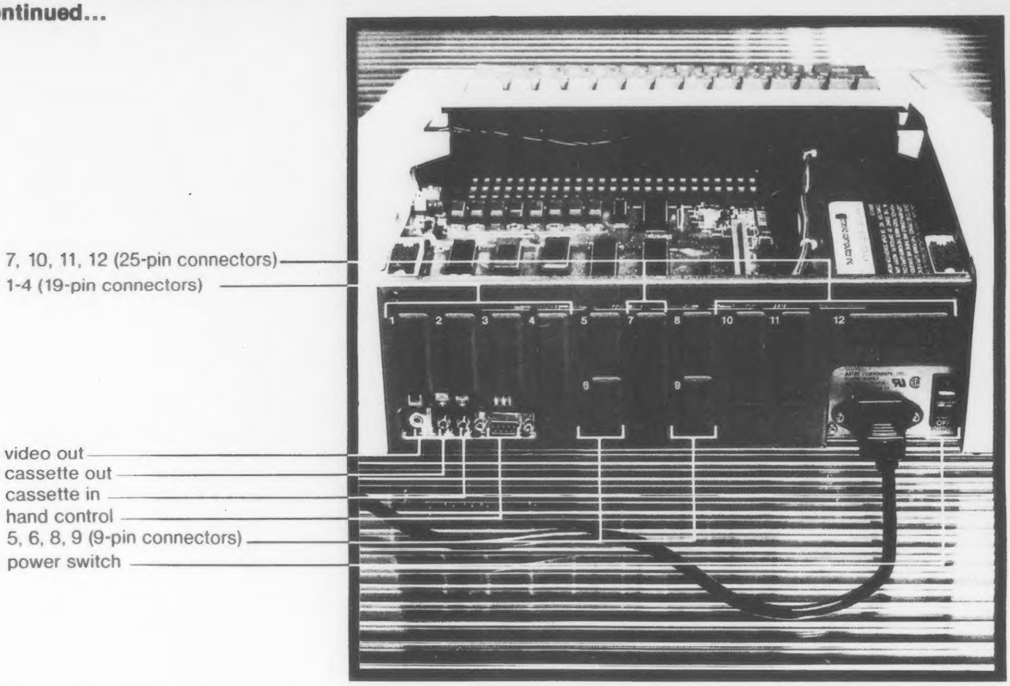


One chip, called the Memory Management Unit (MMU), contains the Applesoft Basic language, 80/40-column support, the enabling ROMs, and keyboard reading circuitry. The other, the Input/Output Unit (IOU), acts as controller for the CRT display, cassette interface, and speaker. Getting properly functioning samples can take as long as a year. But because Walt kept both chips at a relatively small size (110 mils on a side, or 12,100 square mils, compared to a typical 64K RAM chip size of more than 30,000 square mils), and by using similar gate design in both, Synertek delivered two custom chips in December 1981, just 26 weeks after Walt handed them his design.

In his development, Walt used an emulator circuit board—the chip-filled board he had brought into the meeting—configured such that all he had to do was unplug two jumper cables, disabling 102 smaller chips he used as initial building blocks, and plug in the two custom chips to see if they worked. Both sample chips worked the first time!

Compatibility

The prime concern among potential customers, of course, is the compatibility of Apple II software, hardware, and firmware with the new Apple IIe. And how the hundreds of companies currently selling Apple supporting products will respond to the new unit.

From the outset, the design of the Apple IIe was built around making the new machine as compatible as possible with II Plus. But Apple went one step further as we'll see.

Peripherals such as disk drives, monitors, printers, and modems are reported to be 100% compatible. Expansion slots are completely compatible, because the same signals are at the same pin locations as on the old II Plus.

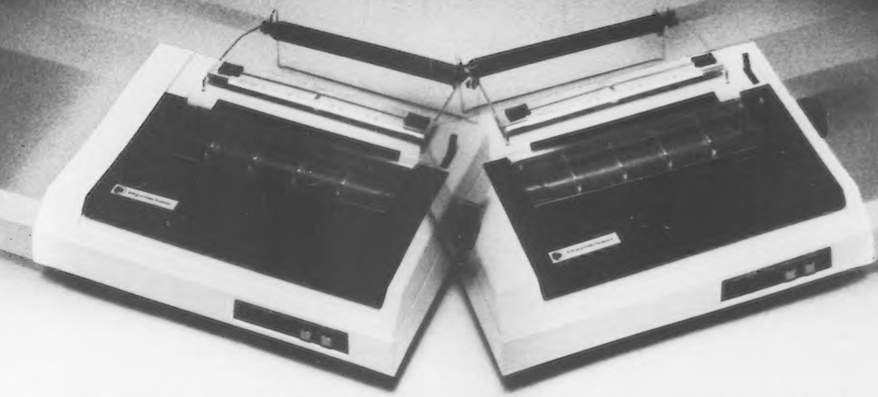
There is a single, 140-page spiral bound "Owner's Guide" that not only gets the user up and running, but is one of the best introductions to personal computing I have seen in a long while.

Software is largely compatible. The only difficulties would occur in a word processing software program, for example, that is not written to support an 80-column display. In that case, only the 40-column mode would be operable.

In tests of a lot of software, Apple engineers discovered that some software utilizes copy protection schemes that look for very specific codes in memory locations throughout the machine. This way, if the program fails to receive the right codes, it "thinks" it is on a non-Apple machine thay may be trying to copy the disk, and won't boot the disk. On the Apple IIe, those codes may not be in the same place as in the Apple II, so the disk would not be usable.

Another incompatibility problem will occur in accessory cards or firmware that play tricks on the Apple II to operate. For example, some cards require the removal of a chip from the Apple II motherboard. On the IIe, that chip may be incorporated in another, larger chip, making it impossible to disable its functions. Also, programs written in the monitor using entry points not recommended by Apple will have problems. Applesoft Basic programs, however, will be compatible.

To smooth the changeover from II to IIe in the software and hardware accessory ends, Apple has been actively engaged in notifying every vendor of Apple-compatible products they could unearth about impending changes in the Apple. For more than six months, the company has been providing cooperating companies, on a non-disclosure basis, with an Apple IIe for software/hardware evaluation and development. (The in-house name for this effort was the Apple Seeding program, perhaps with apologies to Johnny Appleseed.) Those vendors who needed or wanted to



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CIRCLE 185 ON READER SERVICE CARD

Recommended Slots

Peripheral Card	*DOS*	*Pascal Operating System*
Apple IIe 80-Column Text Cards	AUX CONN	AUX CONN
First disk controller	slots 1–7*	slot 6
drive 1 cable	opening 1	opening 1
drive 2 cable	opening 2	opening 2
Second disk controller	slots 1–7*	slot 5
drive 3 cable	opening 3	opening 3
drive 4 cable	opening 4	opening 4
Silentype interface	slots 1–7*	slot 1
printer cable	opening 6 or 9	opening 9
Parallel interface	slots 1–7*	slot 1
printer cable	opening 7, 10, 11 or 12	opening 12
Super Serial interface		
for printer	slots 1–7*	slot 1
printer cable	opening 7, 10, 11 or 12	opening 12
for terminal	slots 1–7*	slot 3**
terminal cable	opening 7, 10, 11 or 12	opening 7
for communications	slots 1–7*	slot 2
cable to modem, etc.	opening 7, 10	opening 10
Graphics Tablet interface	slot 5 opening 5	(does not work with this Op Sys)

*Do not use slot 3 if there is a card installed in the AUX CONNECTOR slot.

**If you connect a terminal using slot 3 under the Pascal Op Sys, make sure there is no card in the AUX CONNECTOR slot.

make changes have had time to make those changes and have software ready in time for the introduction of the machine.

Apple claims that most vendors welcomed the advance information. The companies were apparently pleased to learn that, although the IIe necessitated some changes or additional software offerings, their products would continue to enjoy a growing market with the new machine.

Apple itself will have two redesigned programs from its own software library to be introduced with the IIe. *Apple Writer* will support the 80-column display (when installed), as will a fast-sorting electronic database management program I saw, called *Quick File.* Both programs will also make use of the 128K, expanded RAM in systems so equipped (the 6502A, of course, can address only 64K RAM directly—the balance will be under software direction).

One Manual For All

Documentation supplied with the Apple IIe deserves special note. Gone, but available as options, are the "techy" Applesoft reference and DOS manuals that have overwhelmed many a computer novice. Instead, there is a single, 140-page spiral bound "Owner's Guide" that not only gets the user up and running, but is one of the best introductions to personal computing I have seen in a long while.

Chapter One goes through the initial set up of the system. The next chapter is a guided tour of the system and instructions on loading a tutorial disk, called "Apple Presents Apple," supplied with the manual. Chapter Three presents an uncomplicated and cleverly illustrated explanation of how the Apple and disks work. Then a chapter devoted to DOS 3.3 (in which you learn that DOS and Basic require the CAPS LOCK key to be engaged), plus its most important commands and error messages.

Chapter Five discusses all the things you can do with your Apple from an application point of view (electronic work sheets, word processors, database management, telecommunications, graphics) along with suggested software and peripherals—some even from outside suppliers. There is no Basic language instruction here, but the manual discusses several languages to pursue on your own with the help of other Apple manuals or software. Featured are Applesoft and Integer Basics, Pascal, Fortran, Logo, Pilot, and 6502 Assembly Language.

The balance of the manual covers other peripherals, troubleshooting tips (there is a limited self-test built into the IIe), books and magazines worth reading (of course *Creative Computing* is listed!), glossary, and index.

The last point in our discussion—and one in which I was particularly interested, having seen all this simplified power set up before me—was pricing.

Paul Dali returned to field this subject. Final pricing was not completed, but the cost of a basic 64K, 40-column Apple was planned to fall between $1300-1400, or roughly the cost of the 48K Apple II Plus. The best bargains, Paul was quick to note, will be in packaged systems, just as they were for the Apple II. System packages featuring the old II Plus computer, one disk drive, a monochrome monitor and a software package or two for around $2000 represented good consumer values. Such packages will exist for the IIe, with several "soft solutions" available by the end

Hayden

programming by numbers...

PET GR
Nick Hampsh
The BASIC Conversion Handbook for Apple, TRS and PET Users
BASIC Computer Programs for the Home
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BASIC Computer Programs for Business
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The BASIC Conversions Handbook for Apple™, TRS-80™, and PET™ Users

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CIRCLE 174 ON READER SERVICE CARD

of 1983 depending on the markets the company is pursuing.

Impressions

That the new model sports the same case design and color as the veteran II Plus was no disappointment. Even after all these years, it is still a pleasing shape which I am not tired of seeing. And while a detachable keyboard would be a nicety, I fully understand maintaining a form factor that has such ready recognition with the Apple name.

The degree to which care had been applied to making the IIe as compatible as possible with its forerunner was a happy surprise. A company with the apparent marketing muscle of Apple could have tried to "brute force" its way into creating some new personal computer standard that would have been much less compatible.

A consumer benefit coming from the redesign of the motherboard is not the increased reliability coming from two-thirds fewer chips, but ability to assess all chips with the top off. This will speed service turnaround if one circuit should go bad.

The reduction in chip count also lightens the load of a power supply. The eight 64K dynamic RAMs in the IIe dissipate less power than all the 16K RAMS in the II. In fact, in an early stage of design, the power supply (at first it will be the same as in the II Plus) was "looking" at a circuit that wasn't meeting even the minimum load requirements for a properly functioning II Plus. The supply had to be artificially loaded by converting some of the excess capacity to +5 volts available to peripheral cards. The net result is about one extra ampere of current available for the seven slots to share. Moreover, the 6502A, running at less than optimum speed, does so, only cooler. All this leads to a cooler running computer, likely to be even more reliable than the II.

Apple has been testing working models for about a year. Reliability studies, Walt Broedner claims, have shown the IIe to be more reliable than the II. The units have survived operation in temperatures below 0° Celcius and over 90° Celcius.

The biggest disappointment came at the discussion of price, especially after hearing how efficiently the unit could be manufactured and tested. I didn't expect the IIe to wallow around in the under-$300 mud with the popular home computers, but I did expect, or hope to see the IIe come in at around $700-800, even for just 48K RAM. So the standalone price of $1300-1400 for a 64K unit seemed terribly high to me.

That's the benefit of making a computer with over 10,000 applications on the shelf. Serious computer shoppers are looking for solutions. If the software solution exists, and it happens to run only on an Apple, then Apple it will be, even if it is more expensive than other, comparably equipped machines.

The advance planning with outside software and hardware vendors was equally encouraging. The company appears to want everything 100% right before it unleashes its new offspring. That Apple was ramping up production and had a finished, printed Owner's Manual more than two months prior to formal announcement augurs well for a consumer-painless introduction of a product that will be in high demand and expected to work the first time.

Strip away the price factor, and you are left with a near perfect computer with enough power to take most personal computer users up to moderately sophisticated applications. The IIe is everything the Apple II Plus should have been a year or two ago, when it underwent development. Emerging, therefore, as it does in these turbulent times in the industry, the Apple IIe is a remarkably evolutionary personal computer. ☐

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Getting Serious With The Color Computer

John Steiner

The TRS-80 Color Computer has been a part of my life for over a year. I started a project to write a book, and after spending a few long hours in front of the typewriter, I realized a word processor for my computer would be nice.

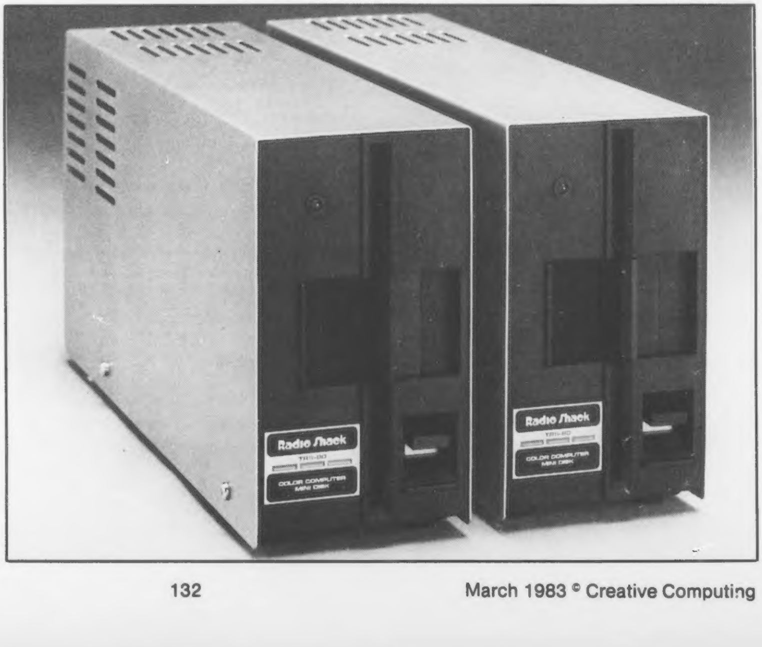
One of the necessary accessories would be a disk drive. Cassette program files have their place, but for a project as large as text files, a disk system is indispensable.

The current choice is between Radio Shack's disk system and the Exatron disk operating system. I chose the Radio Shack system for two reasons: it should be compatible with future Tandy software releases, and the DOS is in ROM.

> **I felt only slightly handicapped by having to relinquish 2K for the disk buffer.**

Tandy has provided an excellent operating system for the Basic programmer who doesn't want to learn to use a disk operating system. The 35-track double density system is completely transparent to the programmer. No "system" or special DOS handling is required to operate the system. Even though I am a novice programmer, I was able, using the Disk System manual, to write and use a Basic word processor.

Another advantage of the ROM-based DOS is that no space is taken either on the disk or in RAM for DOS. The only disk space not available for user files is track 17, the disk directory. Only 2K of overhead is required for disk buffers,



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How good can a $129 package be?

JACK is a single program that performs word processing, calc analysis, and file management in a fully integrated easy to use environment. JACK competes with integrated packages selling for $495, $695, and "under a $1000". Why did we price JACK at $129? Because we believe that everyone needs integrated software and we think we can sell ten copies of JACK to our competition's one.

Process words with ease.

For starters, JACK allows 1, 2 or 3 column on-screen editing – try that with another word processor. With JACK, what you see is what you get. There are no hidden formatting directives to confuse you. JACK lets you insert, delete, copy, set tabs and margins, do fill and right justification. All commands are menu driven so you always know what comes next. For serious word processing you will want an 80-column card (we recommend Videx) and a shift key wire mod – but JACK works with a 40 column screen, too.

Free form calc analysis.

JACK lets you embed calculated values right in the middle of your text. Calculation rules are spelled out in English using names of fields you create (like INVENTORY or PROFIT). Full IF THEN ELSE logic, +−*/, exponentiation, string matches, greater than, less than, AND, OR, and NOT operations let you specify very complex calculations. JACK allows up to 100 calculation rules. If you are doing large spreadsheet work, use a spreadsheet program (we recommend our Senior Analyst Package available exclusively from Apple Computer of course). But for the rest of your calc analysis, you'll find JACK a pleasure to use.

Manage files your way.

JACK supports 60 files on an Apple II floppy disk. A maximum of 1000 records can be stored in these files. Each record can have up to 100 fields ranging in size from 1 character to 1000 characters. JACK lets you sort and select these records by any arithmetic combination of fields. Best of all, you can use the word processing features of JACK to create and modify your file definitions and the calc rules to automatically calculate values.

Which way is up?

Since JACK provides all these features in a single program, you need no longer worry about where the up arrow key has gone when you switch from calc to word processing. Screen handling, backspacing, and file naming don't change with each new application. You need not bother about data interchange formats, file structuring techniques or the other nonsense that you have to go through to transfer information from one package to another. You also don't have to worry about whether your new word processor wants an 80 column card that your old calc package can't stand. In a single simple environment, JACK does it all.

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requires Apple II with 64K memory and 2 disk drives

CIRCLE 119 ON READER SERVICE CARD

and this can be reduced using the FILES command.

As a result, you can have a disk operating system on a machine with only 16K of memory. Before upgrading my machine to 32K, I felt only slightly handicapped by having to relinquish the 2K for the disk buffer.

Disk user file capacity is 156,672 bytes, and a maximum of 68 files can reside on a single side, of a soft-sectored 5 1/4" disk. The files are catalogued in TRSDOS fashion, with an 8-byte file name and 3-byte extension.

The drive 0 package includes a single drive unit, a ROM disk controller pack, drive connecting cable, and an instruction/programming manual. Another drive can be added to the system if required, and an optional four-drive cable allows interfacing of up to four drive units. One requirement of the disk system is that your Color Computer have Extended Color Basic.

A single drive unit has been in operation on my Color Computer for about six months, and has operated almost flawlessly. The only problem I have noted concerns television interference. There is a notice included with the unit that warns of television interference when you are using the drive on an early model computer. My computer, serial number 337, certainly qualifies. I was, therefore, not surprised to notice interference on my home television when I used the drive. I have not noticed any interference on my monitor. Tandy offers to modify any computer that requires correction of the problem. I have never felt it was severe enough to have corrected. Besides, I couldn't bear to be without the computer for the few days that the modification would take.

Since the drive unit has gone out of warranty, I have had only a couple of minor problems. Occasionally the DOS would not initialize properly, and either the computer would be locked up or Basic would work but disk Basic commands would only bring a response of ?SN ERROR. I traced the trouble to dirty contacts on the ROM pack where it plugs into the Color Computer, and used a pencil eraser to clean the contacts.

The only other problem I have had occurred when the drive unit would respond only with I/O errors. I tried LOAD, SAVE, and DIR, and all gave the same error message. Since the unit was out of warranty, and since I have had some experience with electronics, I used a phillips screwdriver to remove the drive from its case.

The problem turned out to be quite simple. The drive belt had simply slipped off the flywheel. After reinstalling the belt, the drive again performed flawlessly. I don't know why it slipped off, and it hasn't happened again in nearly two months.

First, The Bad News

As you can probably tell, I have no real complaints with the drive, however as with all equipment, there are a few things that I dislike. Included in this list are the following. Utilities seem to lack sophistication. As an example, BACKUP requires a formatted disk, unlike Model I and III TRSDOS which formats during the backup process. BACKUP also copies all bytes on a disk, whether it contains only one small file or a full disk. For disks with little information on them it is easier to load and resave those files.

COPY will transfer files from one disk to another, but it requires at least two drives. File access protection routines are lacking. There is no lock or password protection capacity. The only file protection is the write-protect tab.

It provides many features and capabilities that are unheard of on systems that cost twice as much.

Another feature I would like is autostart, or DO files. There is no way to provide a turnkey system as the drive is now equipped. Though variables cannot be transferred from one program to another easily, it is possible to load and run a program from inside another program. My last gripe is the lack of an ON ERROR GOTO statement.

The Good News

There, I got all my gripes off my chest; now for some good news. First, the cost. Though the $599 price on the disk system itself seems high and is comparable to prices for other disk systems (e.g., Atari, Apple), total system price is very competitive. A TRS-80 Color Computer disk system with 32K, and a single drive can be purchased for under $1200 from many suppliers. Compare that to Atari and Apple with the same capacity.

The user manual is written to the same high standards as the two Basic programming manuals. Even though I was completely unfamiliar with file handling on a disk system, I was able to learn as the manual took me step-by-step through sequential and direct access files. I found, to my surprise, that my cassette file programs were transferred to disk with little problem.

Listed below are two file command lines, the upper line creates a text file on cassette; the lower line does the same on disk.

```
1000 OPEN "I", #-1,
"MAILLIST"
1000 OPEN "I", #1,
"MAILLIST"
```

As you can see, the only difference is in the buffer number. This buffer number specifies which file is to be used. To transfer cassette file programs to a sequential disk file, use the line editor to remove the minus signs in the disk statements. Up to 15 disk buffers can be open at the same time. These details are best left to the disk manual.

Another handy command you can use is POKE &HFF40,0. With this command, you can turn off the drive motor. Normally this is not required, as DOS does this for you. I wrote a simple program to transfer disk files to tape for tape backup purposes. One problem with it was that the drive continued to run during the tape write procedure. This is because opening a tape file causes program control to leave DOS and enter the cassette file write routine. DOS doesn't get a chance to shut off the drive. Never use this command while a file is still open. In other words, the command *must* be preceded by a CLOSE command.

The manual includes several sample programs that can be used. The list includes a membership file, checkbook and budget programs among others.

A service manual is available for those hobbyists who are technically oriented. There is a wealth of practical material on preventive maintenance, as well as service and repair information. Maintenance is straightforward; however you run the risk of voiding the warranty should you open the drive unit during the warranty period.

For example, drive speed adjustment is easy. My drive has strobe bars on the flywheel. To adjust for proper speed, insert a disk and use DIR to start the motor turning. Use a small insulated handle screwdriver to adjust the motor speed control while viewing the strobe bars under a fluorescent light. When the row of bars marked 60 Hz looks stationary, the drive is adjusted properly.

When I compare the Color Computer with other home computer systems, I am impressed with the TRS-80 cost/feature ratio. It provides many features and capabilities that are unheard of on systems that cost twice as much. The Color Computer, coupled with the disk system is sure to make large inroads in the home computer market. I have found over the last year that the system is vastly underrated, and has far greater capacity than most people give it credit for. □

Foolproof, Flexible Database Management

Rodney O'Rourke

My search for a database management system (DBMS) began about three years ago when I realized that bringing personal computing into my day-to-day business life could make me more efficient and my business more profitable.

As sales representative for the eastern region of a major company selling paper products—a highly competitive business—my job entails a lot of customer record keeping: competition, contracts, calls, customer facilities, and a myriad of other details.

> **Data Factory *has allowed me to design my own record-keeping system without becoming a programmer.***

After deciding on an Apple II because of the vast amount of software available for the machine, I studied most of the database management systems available and finally settled on the *Data Factory* from Micro Lab. I am not a programmer, and I don't want to be a computer expert. My use for a computer is straightforward: I want it to assist me in the performance of my job, make me more efficient, and help me serve my customers.

I have never regretted the choice of *Data Factory.* First, it is a truly friendly and virtually foolproof program that provides me with the power I need. Second, it was at that time, and still is, the most flexible DBMS available for a small computer. Third, when I signed my first licensing agreement, I found that I had bought people and support as well as software.

Data Factory has allowed me to design my own record-keeping system without becoming a programmer or learning what amounts to a new computer language. But it goes beyond that. *Data Factory* also allows me to manipulate the data in the base in several unique ways and to produce reports customized to my specific requirements. Finally, the sophisticated math package which is an integral part of *Data Factory* lets me massage the figures in ways that approach some of the well-known spreadsheet programs.

Extended Warranty

Data Factory is a single program which includes a first-year "extended warranty" against destruction of the program disk (you get two identical copies of the program disk which cannot be copied). The extended warranty provides for replacement of a damaged or destroyed disk any time in the first year and also provides you with any updated versions that might be issued. I started with Version 3 and recently received my

creative computing SOFTWARE PROFILE

Name: Data Factory
Type: Database manager
System: 48K Apple II
Format: Two identical sets of two 5 1/4" floppy disks, one report disk and one utility disk.
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Price: $300
Manufacturer:
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Rodney O'Rourke, 8 Pleasant View Pl., Old Greenwich, CT 06870.

ViViViViViViViViVi **Videx** INC. T.M.

Videx, a frontrunner in microcomputer peripherals and software, announces two exciting new programs that will make existing software compatible with the 80-column VIDEX VIDEOTERM.

APPLE WRITER][

pre-boot with 80-Column Display

NEC
apple II
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This program allows an 80-column display for your APPLE WRITER][, and access to true upper and lower case input from the keyboard. When combined with the ENHANCER][, this program will provide a complete word processing package.

Interested in word processing in different languages? The pre-boot program has been set up to allow APPLE WRITER][to prompt in other languages. With an Enhancer][, the keyboard can be programmed to be compatible with different languages.

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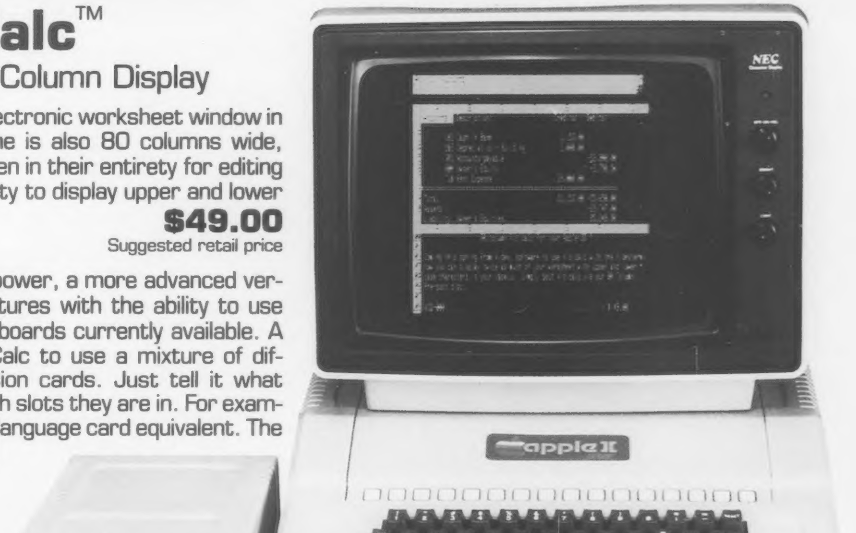

Now you can view the VisiCalc electronic worksheet window in 80 columns. Since the entry line is also 80 columns wide, complex formulas can now be seen in their entirety for editing ease. An added bonus is the ability to display upper and lower case.

$49.00
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For those who need even more power, a more advanced version combines all the above features with the ability to use many of the memory expansion boards currently available. A configuration editor allows VisiCalc to use a mixture of different kinds of memory expansion cards. Just tell it what memory cards you have and which slots they are in. For example, you could use more than one language card equivalent. The memory cards can be combined to give you access up to 176 K of memory!

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Data Factory, continued...

latest copy, Version 5.0, automatically under Micro-Lab's policy, which costs $30 annually after the first year.

In addition, data files developed under older versions of *Data Factory* are still compatible with the newer versions, and can be accessed through Basic, which is not the case with some competitive products. The features in each new version are worth many times the cost of the warranty.

Data Factory can be used with a one-drive system, but it would be clumsy and slow, as is the case with most such programs. My two-drive 48K Apple system uses an IDS 560 printer which I chose for its high speed and 220-column print output. But the features of the software program itself are what make that hardware useful. While some other computer manufacturers have built bigger, faster, and more sophisticated machines than the Apple, no one has built a machine that is more flexible or easier to use.

Special Features

Those features of *Data Factory* that I particularly like include a menu-driven start-up routine that asks you a series of questions about the database you wish to design. After selecting a name for the file, you are asked how many fields you wish to specify in each record, up to a maximum of 88. Each field may be any length up to 239 characters long. You are then asked to enter a maximum length and name for each field. The next step is to tell the program the length of the longest field that you will sort or search, whether you have a printer, and the day's date.

Just that simply, your database has been structured. After that startup session, the program calls its own main menu to allow you to work with the database you have created.

One of the real strengths of the start-up routine is that you don't have to make long-term, unchangeable decisions before you are really sure what the database is going to contain and how you will use it. It is a relatively simple matter to change a field—from 8 characters to 12 characters, for instance—at some later stage.

The item entry in the main menu is data entry. When you select that option, it prompts you for input from the keyboard by displaying the titles of each field you selected and waiting for input. When all field prompts have been answered, the program asks if you wish to store the results in memory or on disk, start over, or correct an item. This last feature allows instant editing without retyping an entire record.

A second data entry procedure allows custom data entry. This mode lets you set up a customized format on the screen, placing constant names anywhere you want, then entering the data to the full screen by using the cursor control keys of the Apple (**I,J,K,M**) to move the cursor about the screen. You design the custom entry format right on your screen with cursor movements and simple commands.

In addition, a set of control characters lets you back up or move forward a field in the record, whether you have entered anything in the current field or not, advance to the next page, or back up a page. This is a remarkably simple system to use, especially for those situations in which data is incomplete at the time of entry.

Powerful List Command

The list command from the program menu allows you to display your files on either the screen or the printer by selected record number. It gives you three ways to do this: in the order originally entered, in a sorted format, or in the order of the last filter (a special sort that selects and sets up an index of records containing certain data you specify).

The menu then goes through a series of questions about how you want the list

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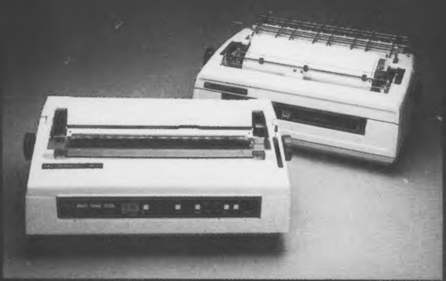
CIRCLE 217 ON READER SERVICE CARD



presented—print field names, line feeds, continuous print, etc. The list command gives the user great selectivity and flexibility in what he actually sees or what is printed out from the data file.

The printer set-up routine sets the parameters for producing hardcopy of your efforts. It includes standard print parameters along with such niceties as right justification of fields and the specification of the number of horizontal fields before executing a carriage return.

Unlike most of the rest of the program, the custom output routine demands patience and forethought.

One of the most powerful of all the capabilities of the program is the custom output routine, which allows you to create custom outputs to the printer or monitor and to operate the comprehensive math functions intrinsic to the program. You control every phase of the final apppearance of the report, enter text of up to 4000 characters any place you wish, place the fields at any location on a form, and print out up to 254 columns wide and 249 lines deep. Using the custom output mode, you can write the particular document back to the disk as a separate file at any time, which I believe is a unique capability among microcomputer database systems.

Unlike most of the rest of the program, the custom output routine demands patience and forethought since it must be told what to do at every step. Once the report looks the way you want it to, the custom format can be saved and called up instantly for future use, or edited still further with powerful editing commands.

Using custom outputs, you can command simple formats such as two-up mailing labels or complex formats such as checkbook entries related to a companion general ledger database structure.

The math and manipulation routines give you such standard operations as addition, subtraction, power, sine and cosine, and random number generation, as well as such complex capabilities as natural logs, conversion of degrees to radians, modular arithmetic, and logical not operation. All are handled in reverse Polish notation, which may be the most logical kind of computer entry system for arithmetic computation. Instead of saying 2 + 2 = as we have been taught from our pencil and paper days, the equation is entered from the keyboard as 2 enter 2 enter +.

Move Data To New Format

While Inspect/change functions are common to most databases, the additional update and transfer routines of *Data Factory* allow you to change the existing database input or output structure, then move the data over to the new structure without reentering the data. These are among the most useful and powerful of all the *Data Factory* features in that your own database can grow and change with your needs, rather than being locked into whatever format you set up at the beginning.

A related feature is the construct and append routine, which may be the most powerful routine in the entire system. With the C&A routine, you can add up to 10 new fields to an existing structure, decrease the number of fields, change individual field length, switch field positions around in the file, append records to the existing file, and select which records to transfer by moving them in selected blocks. With C&A, you can selectively back-up individual files on a

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disk rather than copying the entire disk, manipulate the previously entered search and sort characters, append files even though the field lengths do not match, and fix a bad record caused by garbled data, hardware error, or even physical fault in the media.

Many Ways To Search

The search routines are highly flexible in *Data Factory*. You can search by record number or by any of the fields. In addition, you may direct a regular search, which will respond to the search characters CAT with CATholic, CATalog, and CATerer. The command to use internal search would also report back such strings as eduCATe and duCAT. Still another search option finds those records that do not match the search category.

The next level of combining the file is the master search routine which allows you to indicate several items to search for ("scope searching," as it is known on minis and mainframes). The process is known in *Data Factory* as using a filter. You construct as complex a filter as you need to conduct a particular search. A screen menu prompts you through every step of the construction of the filter, which also allows you to implement the logical operators "and" and "or" to produce levels of filter. While levels of filter cannot be added once a filter has been constructed, the command "nop" (no operation) can be designed into the structure and later changed to an "and" or an "or".

Filters can be saved and reused or altered at any time. When a filter is used to process a data file, the index of the file is displayed, showing which records match through all stages and levels of the filter; those that meet all requirements are automatically written to an index on the disk. The save and re-run feature of having the filtered index on disk is a powerful tool for situations in which various reports must be generated over time using the same sorted records.

Like the other routines in *Data Factory*, the sort function allows great flexibility. When entering records, the latest record goes to the end of the file. However, through use of the sort routine, the records can be rearranged numerically, alphabetically, or by date and can be restructured in either ascending or descending order. The *Data Factory* also allows sorting by one-level (the regular sort) or by multi-level which permits up to four levels of sort, such as sorting one field by name and another by date.

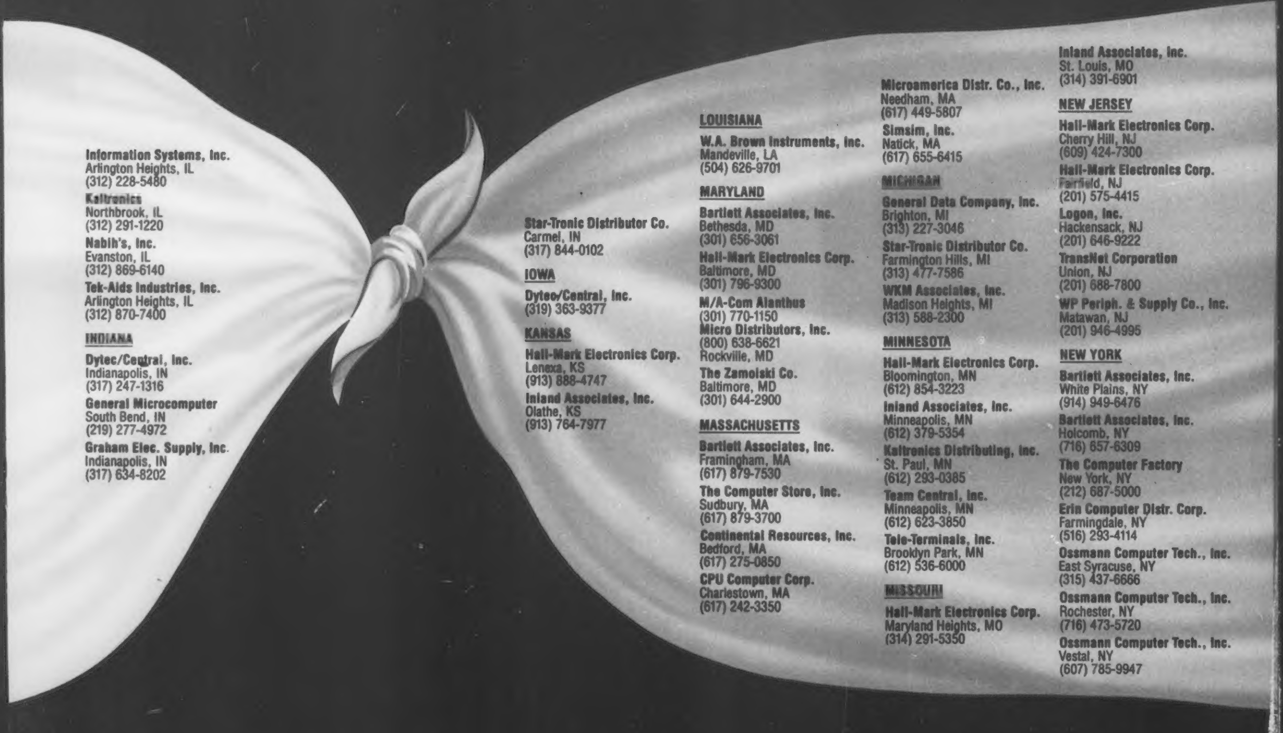
The sort routine automatically compacts all files as it is used, giving you maximum data storage efficiency on the disk.

Three Ways To Index

Another powerful, automatic feature of the *Data Factory* is its index routine, which provides three different kinds of indexes to the data in the file.

First, you can print out or display on the screen the first appearance of data in the field searched. The routine will show the record number of that first appearance. Second, you can construct an index for all appearances of the particular search word. Finally, you can get a count of the number of times it appears in a file.

As an example, let's presume that *Data Factory* is being used in a hospital emergency ward. By using the first option, you could search a field called "location of injury." The first option would print out a list: arm, hand, eye, ankle . . Using the second option, the listing would present arm 12,23,39; hand 16,26,27,41; eye 6,9,20,45, showing which records contained the search word. By using the third option, the listing would show arm (15), hand (11), eye (7), ankle (12), indicating the number of times each type of injury appeared in the file.



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Applying It In Business

In any database manager, the ability to delete data, formats, files, and records is vital in keeping the file up-to-date. With *Data Factory*, which stores up to 10 formats, any one can simply be killed. All such deletions are done from a prompting menu. Individual files can be killed in one action, which is a great time-saver. Records can be deleted from files individually, in groups according to a common field, or by blocks of record numbers. In many cases, *Data Factory* asks a fail-safe second question to make sure you really mean to delete what you ordered deleted.

You could have* Data Factory *show everyone in the Boston area, and then schedule visits around those customers and prospects.

How this all can come together in your business life is shown in the database that you can design using *Data Factory* and use every day in dealing with customers and prospects.

The database could be made up of up to 86 fields and contain all the normal kinds of identifying data, such as name, ownership, address, phone, key contact, estimated paper usage, and so on. In addition, it could contain a section on how the customer handles its paper supplies, storage available, amount used, type of paper used, cores preferred, etc.

Another section could deal with contracts with these customers, how much paper they cover, cumulative sales history in volume and dollars, expiration of contracts, and related information. Still another section could deal with competition: who else the customer buys from, how much, when their contracts expire, plus some confidential information for use in dealing with individual customers.

You could access this information in a number of ways to make your productive hours—the hours spent with customers—more profitable. One obvious way is to check expiring contracts regularly, both yours and your competition's, and then make special efforts against those prime prospects.

Another way might be in scheduling trips. Say you are going to Boston. You could have *Data Factory* list all your customers and prospects in the Boston area and then schedule visits around them.

Still another use is in emergency situations. Say there is a fire in one of the plants that means production will be down for a significant time. You could have *Data Factory* instantly produce a list of customers who rely on production from that mill, and find them alternative sources of supply even before they know that there is a problem with their primary source. That is the kind of service to which a customer is entitled, but which is very hard to do manually. It is just the mindless kind of filter that the Apple does very well.

Summing Up

Salesmen used to do all those things manually—with a lot of difficulty, pieces of paper, and time. Now they can do them all with an Apple computer and *Data Factory*, and find that they can be more efficient, more valuable to their customers, and especially, more profitable. I recommend *Data Factory* to anyone who needs quick access, with tailored output, to a complex database, but who does not want to become a computer expert. ☐

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If you just bought another computer, boy are you gonna be sorry.

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The new Epson QX-10 is unlike any personal computer you've ever seen. It's a computer for people who don't have the time to learn computers; a computer you can be using within minutes.

And fortunately, you don't have to take our word for it. Here's how *Byte*, one of the computer industry's most prestigious magazines, describes the QX-10.

The first anybody-can-use-it computer.
"The Epson QX-10 (is) a computer for less than $3000 that may well be the first of a new breed of anybody-can-use-it 'appliance' computers ... In addition to being a highly integrated word processing/computer system that offers as much usable processing power as almost any existing microcomputer, the QX-10 ... system is designed to be used by people with minimal technical knowledge. We've certainly heard that claim before, but Epson has delivered on this promise in a way and to an extent that *no* microcomputer manufacturer has done."

That's nice to hear from a magazine like *Byte*, of course, but it doesn't surprise us. It's just what we intended the QX-10 to be all along.

More computer. Less money.
But useability isn't the only thing the QX-10 has going for it. As *Byte* says, "the QX-10 gives you a great deal for your money.

"Help is available at any time through the HASCI (Human Application Standard Computer Interface) keyboard Help key ... Text can be entered at any time just as you would in a conventional word processor. The Calc key turns the system into a basic 4-function calculator. Graphics can be created via the Draw key. The Sched (schedule) key gives you access to a computer-kept appointment book, a built-in clock/timer/alarm, and an event scheduler."

Advanced hardware for advanced software.
As for hardware, *Popular Computing*, another industry leader, says: "The QX-10 includes ... a number of advanced hardware features ... The basic components of the system are a detachable keyboard, a high resolution monochrome display, and a system unit containing two 5¼ inch disk drives. The drives use double-sided, double-density disks (340K bytes per disk) and are amazingly compact ... The QX-10 uses an 8-bit Z80A microprocessor. The system contains 256 bytes of RAM. Some of the RAM is ... battery powered ... which lets the computer retain information when the power is off."

You won't have to wait much longer.
The new Epson QX-10 may very well be the computer you've been waiting for. And fortunately, you won't have to wait much longer — it will be appearing soon in computer stores all across the country. In the meantime, write Epson at 3415 Kashiwa Street, Torrance, CA 90505, or call (213) 539-9140. We'll be happy to send you copies of our reviews.

After all, as *Popular Computing* puts it, the QX-10 will "do for computing what the Model T did for transportation."

And we couldn't have said it better ourselves.

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CIRCLE 164 ON READER SERVICE CARD

Electronic Canvas

John Anderson

The Possibilities

You may be getting tired of hearing me rave about the graphics potential of the Atari. Well I'm not going to rave anymore — I am just going to show you some pictures. They will save me thousands of words.

Paint is the most ambitious joystick-based drawing system available for the Atari computer. It has capabilities that outstrip systems that cost five times as much. It allows even the absolute beginner to experiment with most of the graphics potential the Atari brings to microcomputing. And it is so simple, even a child can use it. In fact, it was designed with children in mind. I cannot think of a better inducement to kids than a program such as this.

There are actually two drawing programs included with *Paint,* SimplePaint and Superpaint. SimplePaint is an unimposing, scaled-down version of the main program, Superpaint, devoid of powerful features and therefore also of all complexity. SimplePaint stands more as a tutorial starting point than a valuable program in its own right. It is doubtful whether the user, child or adult, will spend much time with it. Not after he discovers the majesty of Superpaint.

The Features

The joystick is manipulated to move a blinking cross hair around the screen. Press the trigger, and the cursor draws. You may choose from nine different "brushes," in nine different widths, for a total of 81 styles of brushstroke. You may choose a brush that paints a wide swath in one direction, and a narrow one in another. You can choose a fine line (resolution to graphics 7), or paint huge areas at a time.

At the bottom of the screen ten "paint pots" are displayed. Move the cursor into one of the pots, and press the trigger. Your brush will pick up the new color. Four of these are solid colors, six are patterns — plaids, if you like. Each of these colors as well as their luminosities can be changed. Each of the plaids can be altered as well. They default to a very pleasing set, but it is tough to avoid playing with them.

Next to the paint pots are two other symbols. One is an H, and when the cursor is moved onto it and the trigger pressed, the help menu appears. Everything about *Paint* can be accessed from its superbly designed system of nested menus. As the user gains proficiency, commands can also be input to the keyboard directly. Thus the system is able to cater to the beginner and the expert alike, without inconvenience to either.

creative computing
SOFTWARE PROFILE

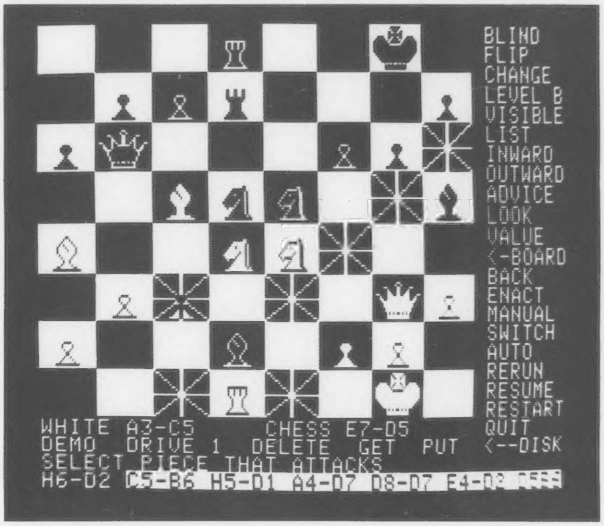
Name: Paint
Type: Graphics composer
System: Atari 800 48K
Format: Disk
Language: Machine/Basic
Summary: Impressive, powerful graphics package making full use of the Atari.
Price: $39.95
Manufacturer:
Reston Software
11480 Sunset Hills Rd.
Reston, VA 22090

The symbol to the far right, looking like squares within squares, is the zoom symbol. Move the cursor onto it and press, and the picture enlarges to graphics 5. Press it again to move to graphics 3. Move the cursor from within these modes, and smooth scrolling takes place. You can travel smoothly throughout the painting in these magnified modes, doing detailed work with great accuracy.

Other commands place real graphics power in your hands. Aside from the direct drawing mode, you can choose the automatic generation of straight lines, rectangles, and circles. They will place themselves exactly where you indicate, in the size and brushstroke you have chosen. This capability is indispensable in building designs. Once closed shapes have been formed, either freehand or automatically, they can be filled with any color or plaid. The fill coloring is quick, perfect, and fun to watch.

Colors and luminosities can be changed as you look at a painting, or as you look at an electronic palette, which indicates the choice on a rainbow-hued color menu. Plaids can be changed only while you are looking at the color menu. The cursor then becomes a roving square. You choose the pattern you want

Explore the Frontiers of Intelligence



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RESUME
RESTART
QUIT
WHITE A3-C5        CHESS E7-D5
DEMO  DRIVE 1  DELETE  GET  PUT  <--DISK
SELECT PIECE THAT ATTACKS
H6-D2 C5-B6 H5-D1 A4-D7 D8-D7 E4-D3
```

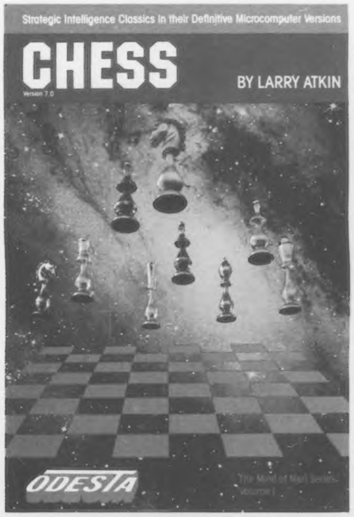
- ◀ Variations of blind-fold play—camouflaged or invisible pieces
- ◀ Invert board to play black on bottom
- ◀ Change pieces on board during game, or set up position
- ◀ Change between 15 levels of play, plus postal and mate-finder modes
- ◀ Show move that **Chess** is thinking about
- ◀ List played moves for each side
- ◀ Lines of force in: attacks and defenses on a square
- ◀ Lines of force out: squares attacked and defended
- ◀ **Chess** suggests a move
- ◀ Show moves **Chess** thinks you will make, and its responses
- ◀ Evaluation of a position
- ◀ Return to board or switch to command menu
- ◀ Take back a move (repeatable)
- ◀ Play move suggested by look-ahead search
- ◀ **Chess** plays neither side
- ◀ Switch sides
- ◀ **Chess** plays against itself—one level against another
- ◀ Replay through most advanced position
- ◀ Skip to most advanced position
- ◀ Start new game
- ◀ Leave program
- ◀ Save, get, and delete games to and from disk

All features self-documented; all choices cursor-controlled
Screen shows "outward" and "look" features being used

THE PEOPLE BEHIND THE PROGRAMS:

Larry Atkin & David Slate: Authors of the Northwestern University Chess 4.7 program—World Computer Chess Champion, 1977-1980

Peter Frey: Northwestern University professor
Editor: **Chess Skill in Man and Machine**
One of U.S. Othello Assoc.'s top-ranked players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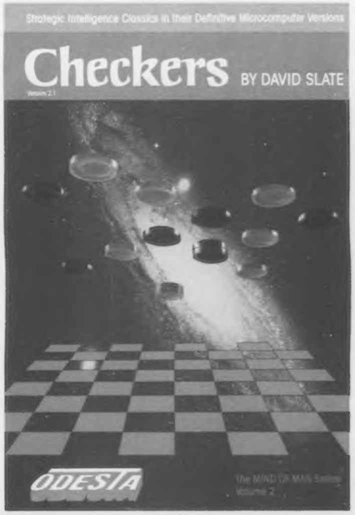
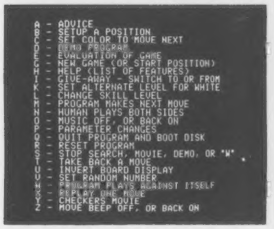
CHESS
Version 7.0
BY LARRY ATKIN
ODESTA
The Mind of Man Series
Volume 1

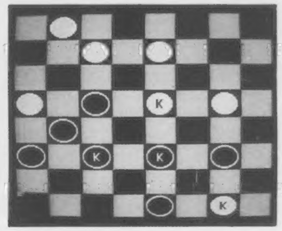

Strategic Intelligence Classics in their Definitive Microcomputer Versions
Checkers
Version 2.1
BY DAVID SLATE
ODESTA
The MIND OF MAN Series
Volume 2

Strategic Intelligence Classics in their Definitive Microcomputer Versions
ODIN
BY LARRY ATKIN AND PETER FREY
Playing by U.S. Othello Association Rules
ODESTA
The Mind Of Man Series
Volume 3

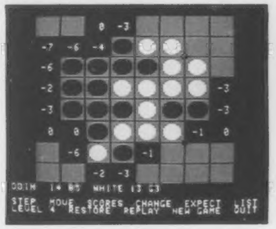


```
A - ADVICE
B - SETUP A POSITION
C - SET COLOR TO MOVE NEXT
D - DEMO PROGRAM
E - EVALUATION OF GAME
G - NEW GAME (OR START POSITION)
H - HELP (LIST OF FEATURES)
I - GIVE-AWAY - SWITCH TO OR FROM
K - SET ALTERNATE LEVEL FOR WHITE
L - CHANGE SKILL LEVEL
M - PROGRAM MAKES NEXT MOVE
N - HUMAN PLAYS BOTH SIDES
O - MUSIC OFF, OR BACK ON
P - PARAMETER CHANGES
Q - QUIT PROGRAM AND BOOT DISK
R - RESET PROGRAM
S - STOP SEARCH, MOVIE, DEMO, OR "W"
T - TAKE BACK A MOVE
U - INVERT BOARD DISPLAY
V - SET RANDOM NUMBER
W - PROGRAM PLAYS AGAINST ITSELF
X - REPLAY ONE MOVE
Y - CHECKERS MOVIE
Z - MOVE BEEP OFF, OR BACK ON
```

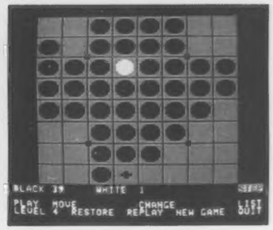
Checkers' features



Black to move and win
(From Checkers documentation)


0 -3
-7 -6 -4
-6
-2 -3
-3 -3
0 0 -1 0
-6 -1
-2 -3
ODIN 14 05 WHITE 13 63
STEP MOVE SCORES CHANGE EXPECT LIST
LEVEL 4 RESTORE REPLAY NEW GAME QUIT

"Scores" feature in Odin


BLACK 39 WHITE 1
STEP
PLAY MOVE CHANGE LIST
LEVEL 4 RESTORE REPLAY NEW GAME QUIT

A clue to the secret of Odin:
Black is destined to lose.

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CIRCLE 218 ON READER SERVICE CARD

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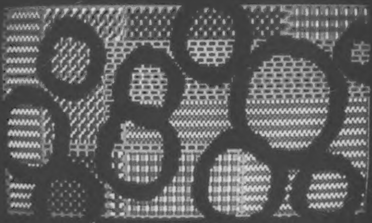

Figure 1. Rectangles filled with a variety of plaids. Black circles "cut" out of the background with a jagged brush suggest a sculptured effect.

All pictures by the author, created with the Paint graphics composing system.

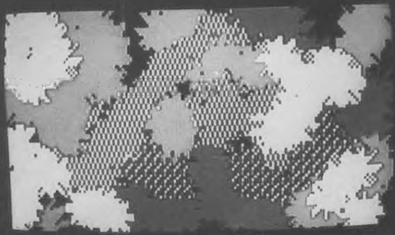

Figure 2. Varied brushstrokes can evoke images of splashes of paint.

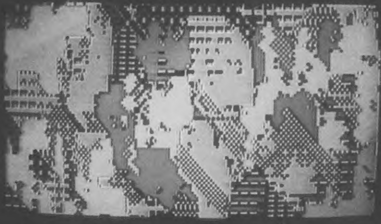

Figure 3. A star-shaped brush resulted in these broad strokes of color and pattern.

The system is able to cater to the beginner and the expert alike, without inconvenience to either.

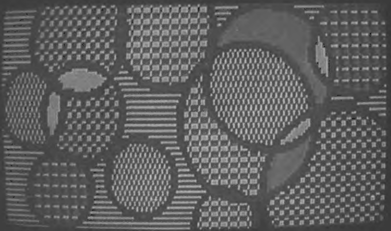

Figure 4. Circles Number 1

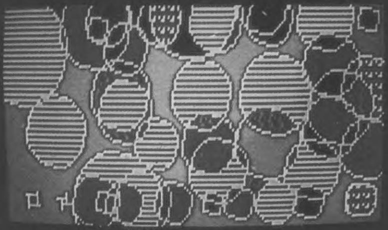

Figure 5. Circles Number 2

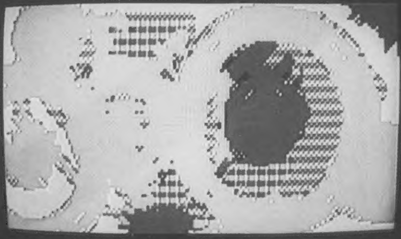

Figure 6. Solid color can be reworked with patterns, resulting in this kind of effect.

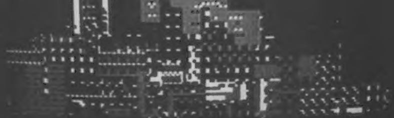

Figure 7. Nighttime Cityscape. I re-saved this painting in dawn, daytime, and dusk color schemes. Viewing them in succession creates an animated effect.

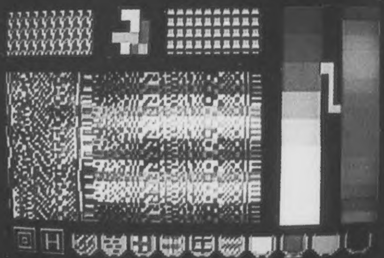

Figure 8. The color menu. Note paint pots at the bottom of the screen. Pattern bars determine plaids. Rainbow of hues indicates color and luminence.

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by placing the cursor on displayed pattern bars and pressing the trigger.

Other features round out the strengths of the program. The responsiveness of the nondrawing cursor can be damped, as can the responsiveness of the cursor when it is drawing. This may seem a trivial feature, but is very handy when doing detail work. I tended toward using a quick cursor when moving without drawing, and a slower cursor when drawing, for added control.

Okay, so you have created a masterpiece. What to do with it? Save it to disk, of course. Multiple pictures can be saved to a single disk. The Art Show feature allows all pictures on a disk to be displayed. You can use multiple drives, and retrieval time is very quick. You may even number the order in which you want paintings to be displayed. You could conceivably create sequences approaching animation using this technique. Press the space bar to pause on a single picture. Press it again to continue. Another command allows pictures to be deleted.

The Concept

Paint is an effort of SuperBoots, a talented and promising software team working for the Capitol Children's Museum in Washington, D.C. The programmers are Eric Podietz, Jimmy Snyder, and Mark Scott.

Obviously intended to be an educational package, *Paint* manages to convey fully the flavorful, imagination-spurring mood fostered at the Children's Museum. As a program designed to involve children, it is a masterpiece.

The Shortcomings

Accompanying the remarkable software is an equally ambitious softcover book, which in addition to documenting the package, attempts to present an overview of art history from the dawn of man to the dawn of microcomputers.

On this account it does not do anywhere near as well. The scope of the task, in contrast to the space alloted, nearly dooms it to failure on the launch pad. The fact that the text suffers from a terminal case of the "cutsies" strikes the fatal blow.

Certain passages of the book strike, like a blow to the vitals. "Nothing, with the possible exception of fire, acne, the wheel and sex, will have a greater impact on your life than the computer," reads the introduction to chapter two. A paragraph in chapter three reads "Yes, no, yes, yes, maybe, hmmm, I don't know, could be, yes, no, no, yes, yes, kind of, oh, who knows?" This kind of drivel typifies what some adults think kids eat up. Sorry; only dumb adults, if anyone, see value in patronizing kids.

In fairness, the book is well-intentioned, and includes some handsome color plates, ranging from Matisse to computer-generated graphics by Mark Lindquist. The book unfortunately ignores the work of Tom deFanti, Abel Associates, and MAGI. In its ineffective but passionate argument for the legitimacy of computer-generated art, it nearly makes the case of opponents like Robert E. Mueller (see "When is Computer Art Art," in the January issue). Proponents of computer art will cringe at the uneven and pronouncement-packed propaganda presented in the text of *Paint*.

Unfortunately, no provision is made for recalling paintings from any other programs.

But wait a minute. The package was designed to stimulate the imagination, and that it does. And despite the fact that the accompanying text is putrid, the package remains superb.

Of course it could have been better. Unfortunately, no provision is made for recalling paintings from any other programs, Basic or otherwise, aside from *Paint* itself. This is a shortcoming that could have been easily set right. Further, the paint pot portion of the screen, which comprises what would otherwise be the text window, cannot be removed, and the images are, therefore, always cropped on the bottom. It was wasteful not to have allowed for paintings to take up *all* the available screen area, with an option to toggle the paint pots on and off the screen. Perhaps these improvements will appear in a future version of the program.

In the title card of the program, fill routines are used to "animate" the image. It would be wonderful if this power were made available to the user. Reston Software has announced another package, *Quick Flix*, for release shortly. It is an animation development package, which may offer this kind of capability.

Despite my occasionally strong reservations about the text, I unreservedly recommend *Paint* as a must for the Atari graphics enthusiast, and the enthusiast's kids as well. At $39.95, it is a worthwhile bargain. ☐

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Pick Six for the TRS-80

Our Favorite Games Feature Apples, Paintbrushes, Frogs, Mines, and an Outhouse

Owen Linzmayer

Very few computers are advertised as game machines, but we all know that more home computers are being used to battle alien forces than to balance checkbooks. The TRS-80, although a relatively primitive computer for game playing, has a wealth of arcade software currently available for it. Reviewed here are the six best TRS-80 games I have seen during the last month.

Apple Panic

In *Apple Panic*, you play the role of a space farmer whose crop of apples has mutated and turned against him. To combat these creatures, you dig holes in the platforms that make up the screen. If an apple falls into a hole, you must bash it until it plummets to its death on the concrete below. If an apple touches you, you lose a life.

The *Apple Panic* packaging promises voice and sound effects. This is a bit misleading. The only time the computer speaks (through the AUX port), is when it displays the banner page. At this time, it says only two words, "Apple Panic." Most of the other games on the market that advertise voice effects offer a much larger vocabulary.

In addition to the printed instructions, *Apple Panic* has thorough documentation accessible from within the program. This includes a scoring table and a review of the controls. The game can be played by one or two players with either the keyboard or a joystick.

The playscreen is divided into five platforms that are connected by ladders. The position and length of the ladders is random, allowing for an almost infinite number of board configurations.

creative computing

SOFTWARE PROFILE

Name: Apple Panic

Type: Arcade

System: 16K Mod I/III TRS-80

Format: Tape/disk

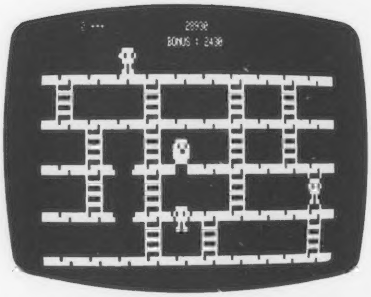
Language: Assembly

Summary: Enjoyable ladder-climbing game

Price: $19.95/$24.95

Manufacturer:

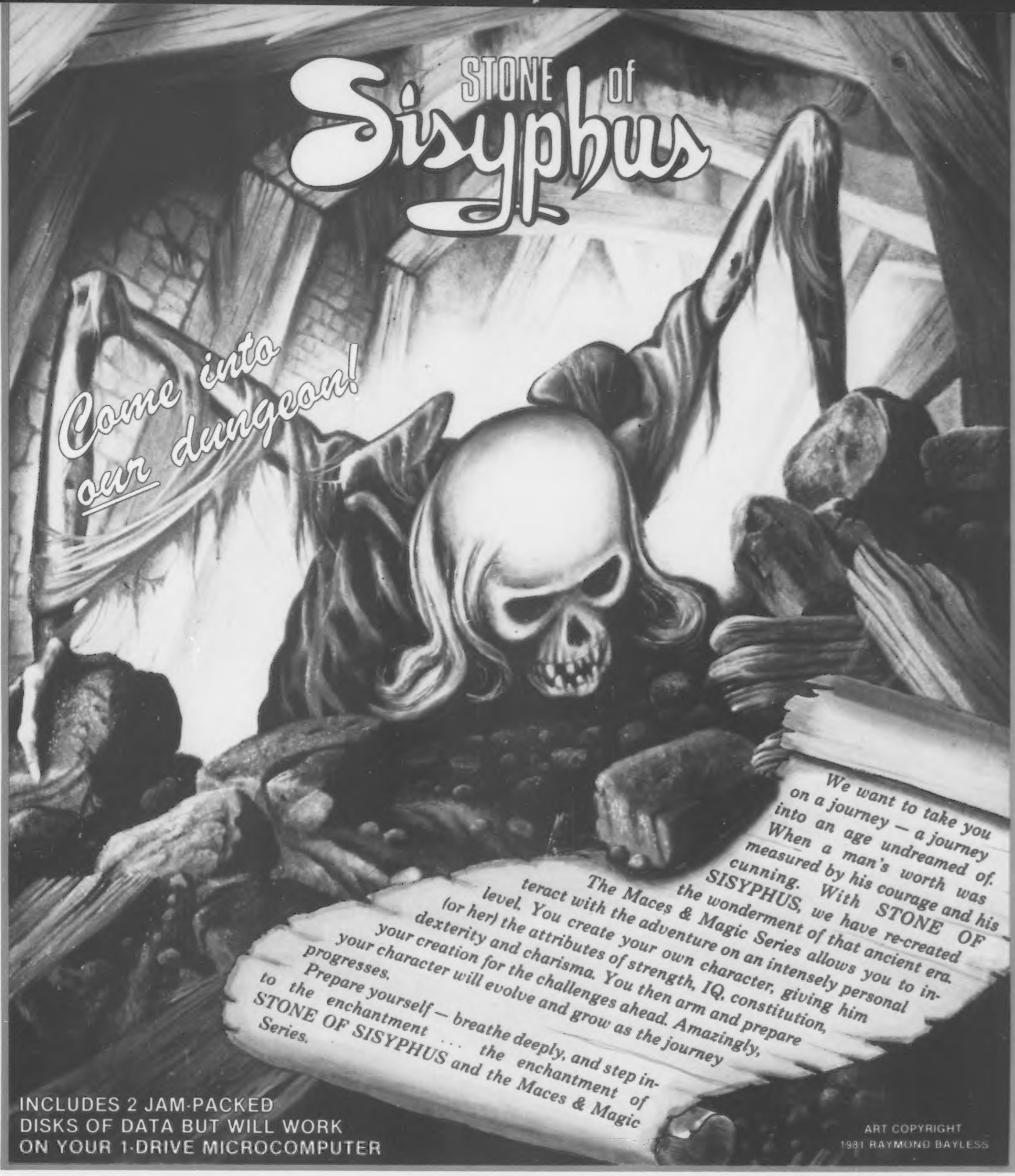
FunSoft Inc.
28611 Canwood St.
Agoura, CA 91301



The graphics are detailed, and the animation is very clear. When one object passes in front of another, it overlays the object in the background, rather than blocking it out.

The sound effects in *Apple Panic* are sparse, but come at appropriate times. The computer breaks into a rich, full-bodied musical number as an aural reward for completing a screen.

If you set a high score, you may enter your name or initials (up to 10 characters) to be added to the high score table. These names and scores are saved



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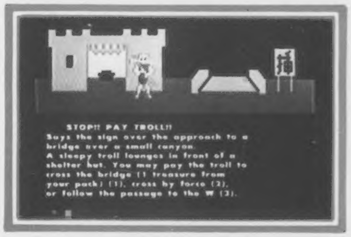
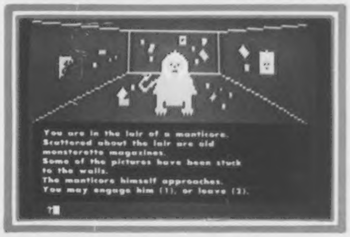


```
     STOP!! PAY TROLL!!
Says the sign over the approach to a
bridge over a small canyon.
A sleepy troll lounges in front of a
shelter hut. You may pay the troll to
cross the bridge (1 treasure from
your pack) (1), cross by force (2),
or follow the passage to the W (3).
```



```
You are in the lair of a manticore.
Scattered about the lair are old
monsterette magazines.
Some of the pictures have been stuck
to the walls.
The manticore himself approaches.
You may engage him (1), or leave (2).

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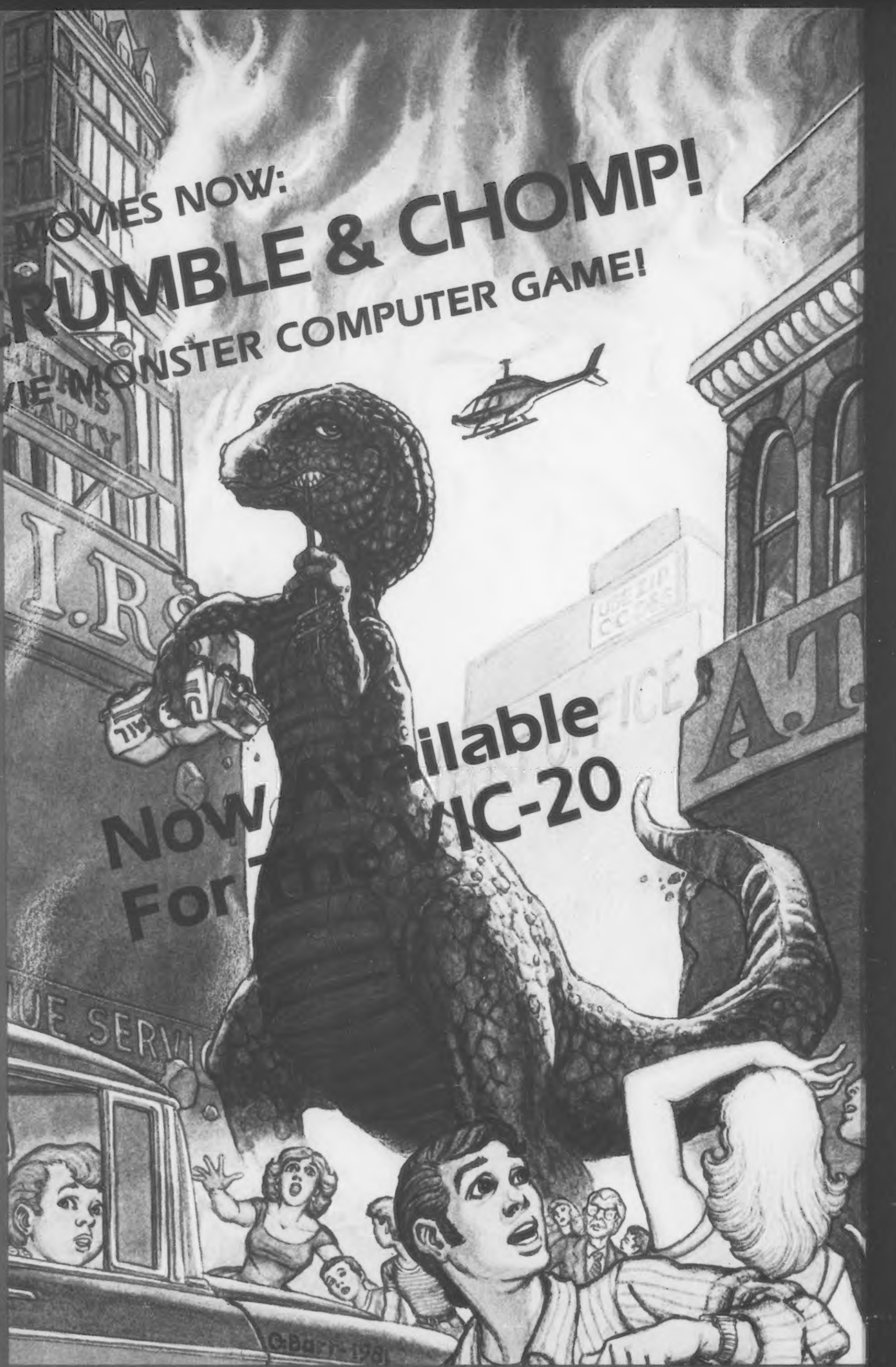

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COMPUTER GAMES THINKERS PLAY

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permanently on the disk version, and are displayed on the instruction screen.

Apple Panic from Funsoft may be well on its way to the top of the charts.

Crazy Painter

Crazy Painter brightens up a TRS-80 software library just as a fresh coat of paint brings new life to a drab room. It is, as far as I know, an original arcade game unlike any other.

Your job is to maneuver a paintbrush around the playfield, trying to "white out" the entire screen. Your mission is hindered by a group of pests that remove the paint that they walk, slither, and crawl over.

Some of the creatures that you encounter are deadly to the touch, others may be run over by your paintbrush. After you finish painting the screen, you advance to a special bonus round in which all of the monsters are vulnerable to your paintbrush. As the game progresses, the action increases as more aggressive foes attack your paint job.

Crazy Painter is a very professional program designed with user-friendliness in mind. There are three pages of internal documentation complete with animation. The game supports both one- and two-player games. If you want to skip the easy rounds of play, don't worry, there are ten selectable levels of starting difficulty. In addition to this, each player can choose his own level.

Crazy Painter is written entirely in machine language by Robert Pappas, author of *Bounceoids* (see review, December 1982 issue). The major attraction of this game is that instead of being represented on the screen by a little graphics character, you actually create the graphic images on the computer screen. The movement of all of the elements in *Crazy Painter* is remarkably smooth, even at high speeds.

I like *Crazy Painter* because as the game progresses in difficulty levels, different creatures are brought into play, thus adding variety to the game. The bonus rounds that you encounter after every screen break up the tension and offer a chance to augment your score considerably.

The one complaint I have with *Crazy Painter* is that there are very few sound effects. Additional sound effects would greatly enhance this game. It has been proven by coin-op game manufacturers that over 50% of the appeal of a game depends on the audio output. I hope more TRS-80 programmers take note of this fact.

creative computing
SOFTWARE PROFILE

Name: Crazy Painter

Type: Arcade

System: Mod I/III TRS-80

Format: Tape/disk

Language: Assembly

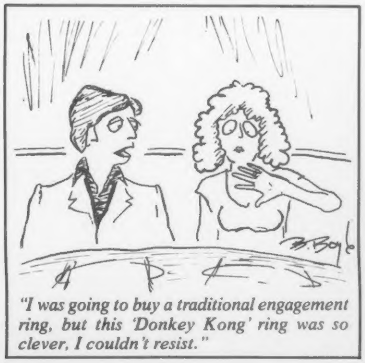
Summary: Very nice original game

Price: $15.95/$19.95

Manufacturer:

The Cornsoft Group
6008 N. Keystone Ave.
Indianapolis, IN 46220
(317) 257-3227

Crazy Painter offers a refreshing break from shoot'-em-up games. The idea is novel, and Robert Pappas deserves credit for taking the time to do some innovative programming.

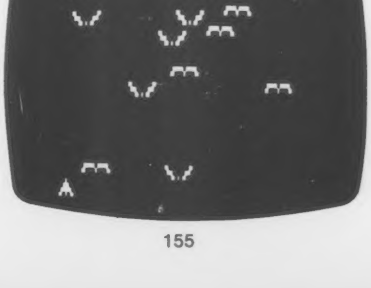


"I was going to buy a traditional engagement ring, but this 'Donkey Kong' ring was so clever, I couldn't resist."

Demon Seed

During the summer of 1982, the theaters were filled with horror films. When I first heard of *Demon Seed*, I mistakenly thought it was the title of a new "insane convict murders entire town" movie. *Demon Seed* is, in fact, a TRS-80 adaptation of Centuri's coin-op arcade game Phoenix.

In *Demon Seed* you control a lone space fighter that traverses the bottom of the computer screen. This ship is equipped with an unlimited supply of ammunition and a protective shield that can be activated for short periods of time.



The enemy takes the shape of large winged bats and demons. Each attack is made up of five separate waves. The first two attack waves consist of bats flying in formation. During the third and fourth waves, you are confronted by swooping demons that you must hit dead-center to destroy. On the fifth wave, you face the demon attack ship. Before you can shoot its pilot, you must blow a hole through both the belly of the ship and the revolving rim. After you destroy this ship, a new attack wave begins. If you survive two attack waves, you get to try your hand at a special challenge round.

Demon Seed is designed for only one-player. Until you become familiar with the workings of the game, it is difficult to attain high scores If you set one of the top ten scores, you may enter your name (up to 20 characters) to be saved permanently on disk.

The ship is controlled by using the keyboard. In addition to the game controls, there are a few special keys that you should be aware of. You can pause the game at any time by pressing P. If you want to abort the game entirely, hold down both the BREAK and CLEAR keys. To turn off the sound effects, press the BREAK key. Options such as this take little time to add to a program, but they make a game much more friendly.

creative computing
SOFTWARE PROFILE

Name: Demon Seed

Type: Arcade

System: 16K Mod I/III TRS-80

Format: Tape/disk

Language: Assembly

Summary: Excellent adaptation of Phoenix

Price: $19.95/$24.95

Manufacturer:

Trend Software
Box 741
Bloomfield Hills, MI 48013

The animation in *Demon Seed* is very good. Attacking creatures flap their wings and drop bombs as they swoop down at your ship. At times, game elements flicker, thus detracting from an otherwise excellent graphic display.

Anyone who enjoys playing Phoenix will find *Demon Seed* a game well worth his money.

Frogger

After Frogger, from Sega Electronics, proved itself in the arcades, manufacturers began clamoring for the home rights to the game. The Cornsoft Group acquired the rights to produce a TRS-80 adaptation of Frogger, and they did a great job. This licensed version is the best I have seen.

In *Frogger*, you control a small frog that you must maneuver across a bustling highway and past a rushing river. You can move in any of the four compass directions using either the keyboard or a joystick. You must avoid traffic, snakes, crocodiles, and diving turtles. If you get five frogs safely onto their lilypads on the far side of the river, you advance to a more difficult level.

creative computing

SOFTWARE PROFILE

Name: Frogger

Type: Arcade

System: Mod I/III TRS-80

Format: Tape/disk

Language: Assembly

Summary: Licensed version of Frogger, coin-op game from Sega/Gremlin

Price: $19.95/$22.95

Manufacturer:

The Cornsoft Group
6008 N. Keystone Ave.
Indianapolis, IN 46220
(317) 257-3227

The sound effects of *Frogger* are every bit as crisp and whimsical as those found in the arcade. The program beautifully emulates frog sounds of the coin-op game.

One problem many game designers face is how to fit an arcade game onto a computer screen. Remember, most video games have screens that are longer than they are wide; the opposite is true of the TRS-80. Rather than squeeze the playfield down to size, programmer Robert Pappas simply split it in two. When a game begins, you see only the highway. If you reach the other side, the river section scrolls down into place. This is a new, effective way to handle an old problem.

This split-screen technique provides for much more detailed graphics than the versions I have seen that use only one screen. Even with the increased detail, it is easy to lose sight of your frog on the river screen, especially when you are riding on a log. If it were easier to differentiate between graphic elements, the game itself would be greatly enhanced.

One or two people can play *Frogger*, each chosing his own difficulty level (0-4). If a high score is set, you can enter a name or message (up to 17 characters) which will be saved on the disk.

The thing that bothers me about *Frogger* is that the controls aren't as responsive as I would like them to be. At times you must wait before you can move. This is maddening and results in many miscalculated jumps—usually into the grillwork of an oncoming car and flat frogs.

Frogger lives up the standard for arcade programs set by the Cornsoft Group. I have never been very fond of the coin-op *Frogger*, but I recommend the TRS-80 version to anyone who is.

Mad Mines

I have heard it said that borrowing from one source is plagiarism, but borrowing from two sources is research. If this is true, then *Mad Mines* is an excellent piece of software research. *Mad Mines* combines elements of two popular Apple II computer games: *Ceiling Zero* and *Space Eggs.*

In *Mad Mines*, you are in charge of a small space cannon that slides along the bottom of the screen. Your mission is to survive as long as possible while eliminating the mines that infest innerspace. If you shoot a mine, its occupant bursts forth and dives down to attack you. Anything that passes below the force field is restricted to this ever-shrinking space. Each time you kill a flock of mines, a new group appears and the force field is lowered. As the action speeds up, your margin for error diminishes rapidly.

You face a total of four different aliens, each with its own pattern of behavior. The most dangerous of these are the ones encountered on the fourth attack wave. If you shoot an egg during the fourth wave, the creature drops straight down at you. If you don't hit the little bugger before it reaches the bottom of the screen, you are dead. This is a perfect example of a "be perfect or die" situation.

creative computing

SOFTWARE PROFILE

Name: Mad Mines

Type: Arcade

System: 16K Mod I/III TRS-80

Format: Tape/disk

Language: Assembly

Summary: Combination of two Apple games

Price: $19.95/$24.95

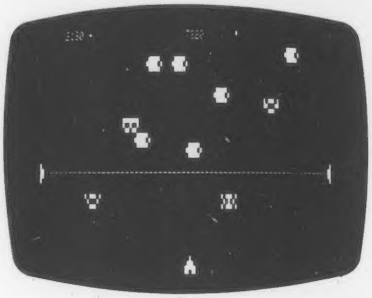
Manufacturer:

Funsoft Inc.
28611 Canwood St.
Agoura, CA 91301
(213) 991-6540

The graphics in *Mad Mines* are absolutely state-of-the-art. The animation of the aliens is excellent and nothing flickers, even when the screen is filled with moving elements. One thing that I do find annoying is that the stars in the background look a lot like the alien bombs. This is confusing and could be corrected by eliminating the scrolling stars.

Rather than simply switch from one screen to another, *Mad Mines* has a variety of transitions that dazzle the player. The graphics demonstrated during these transitions are original and accompanied by sound effects.

Yves Lempereur, author of *Mad Mines*, did an excellent job of creating an all-around enjoyable product. When I showed the game to my co-workers, most of them commented on how much the style resembled a Big Five program. If you know anything about the TRS-80 game world, you know how respected the Big Five name is. To have one's program compared to a Big Five game is a great compliment.



Mad Mines is one of the most professional arcade games available. It is constantly challenging because it requires both dexterity and strategy. I have a special bunch of games that I keep on-hand to show off to friends—*Mad Mines* has earned its place in that limited group.

Outhouse

So, you have just joined the Intergalactic Defense Force. The recruiter promised that you'd see Mars, maybe even Venus. Your orders came in today, and guess what—you've been placed in charge of defending an outhouse located somewhere in Iowa. It's a cushy job, but someone has to do it.

For some strange reason, the enemy has launched a full scale attack on the outhouse. Some of the aliens want to destroy the outhouse, others want to de-

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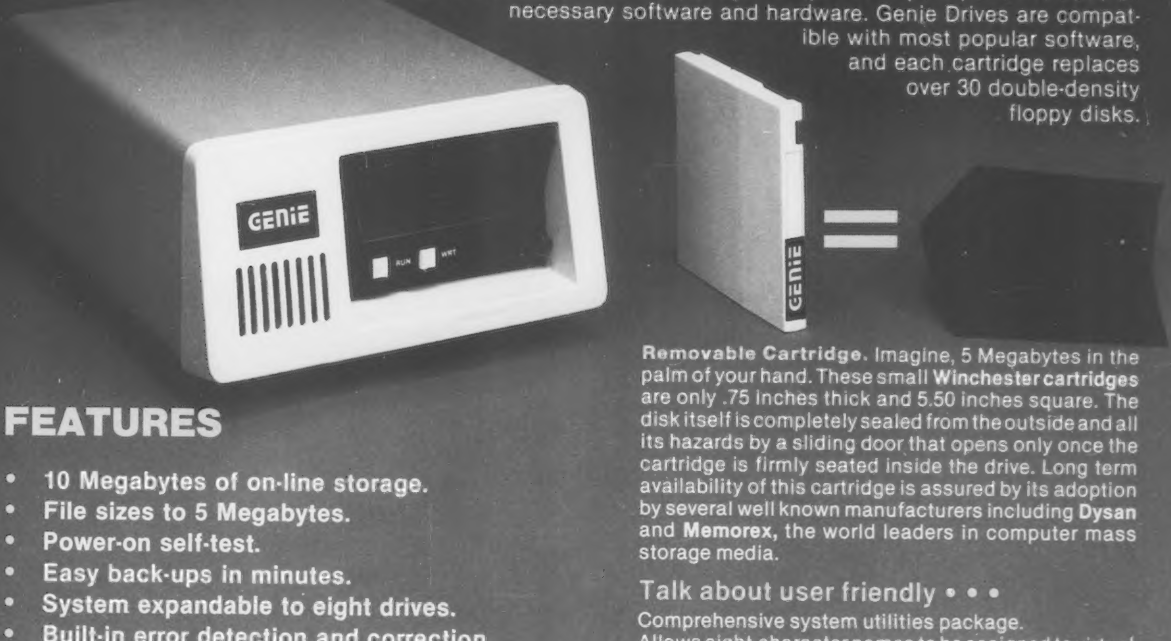

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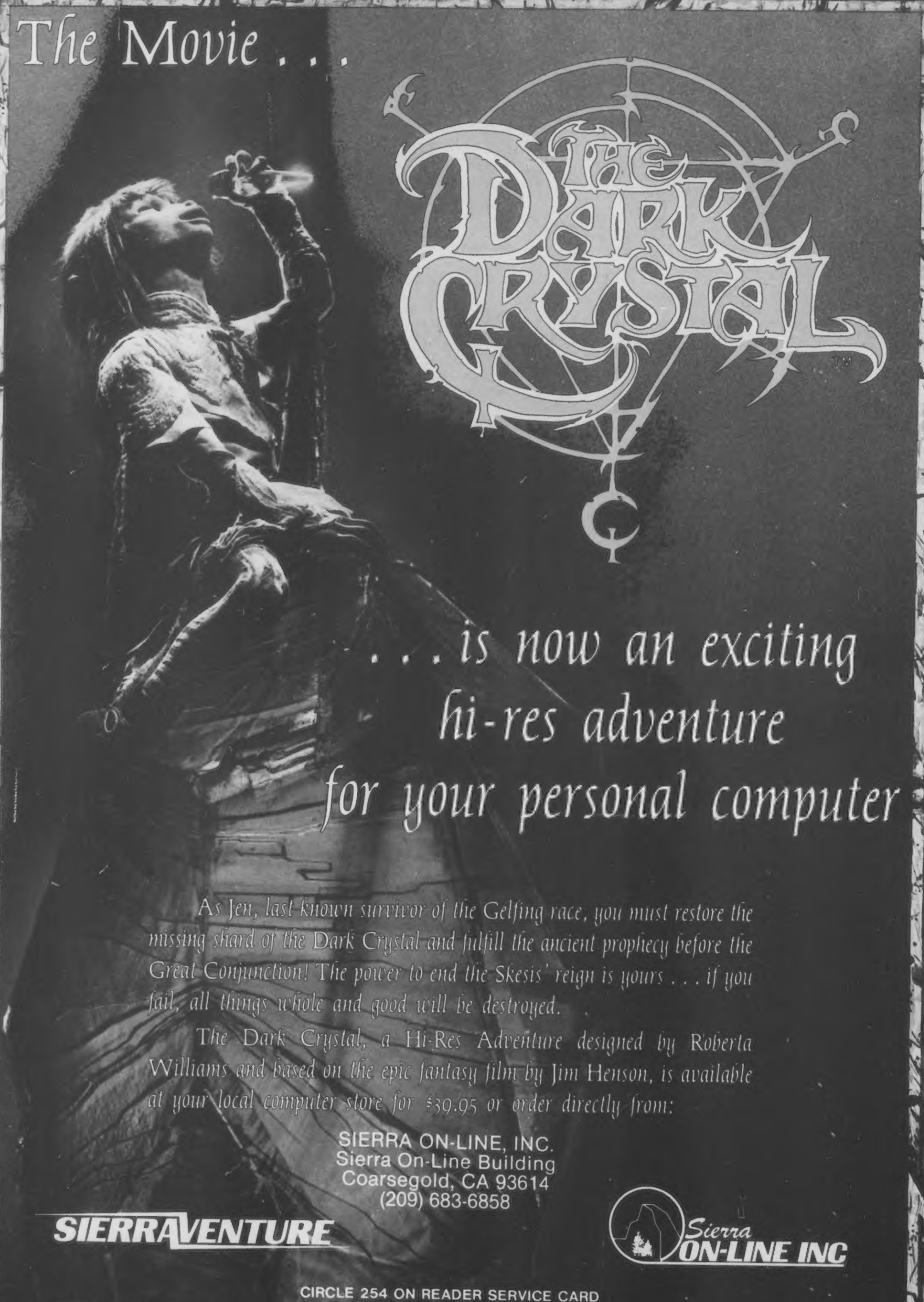

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TRS-80 Arcade Games, continued

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creative computing

SOFTWARE PROFILE

Name: Outhouse
Type: Arcade
System: 16K Mod I/III TRS-80
Format: Tape/disk
Language: Assembly
Summary: Interesting new game
Price: $15.95/$19.95
Manufacturer:

Soft Sector Marketing Inc.
Box 340
Garden City, MI 48135
(800) 521-6504

The action starts off slow, but becomes challenging after the first three attack waves have been disposed of. As you progress, the game brings more aliens into play. There is a total of seven different game elements that are programmed to eliminate you, each in its own special way.

Although *Outhouse* is actually a shoot'-em-up game, it has a strange scenario which elevates it above the usual death and destruction arcade game. Both the game concept and the graphics are original, and there is enough variety here to satisfy even the most jaded game player.

The sound effects are crisp and add much to the program. In addition to the normal complement of space war sound effects, the disk version of *Outhouse* is enhanced with voice effects. During the introduction and intermissions, the computer speaks through the AUX port. The voice is a bit coarse, but everything that is said is understandable.

One or two players can play *Outhouse*, alternating turns at the controls. If you set a high score, you are allowed to add your name to the scoreboard. There are two high score charts: all-time, and daily. The top eight all-time scores are saved to disk, whereas the daily scores disappear when the system is turned off.

If *Outhouse* wasn't a good program, it would at least deserve credit for being original. Luckily, it is a great program. I recommend *Outhouse* to anyone looking for a fresh idea in game playing, as well as the hardened arcade addict. ☐

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CIRCLE 266 ON READER SERVICE CARD

Bugs, Space Ships and Racquetball For The Color Computer

Owen Linzmayer

Cheer up all of you TRS-80 Color Computer owners, quality programs are making their way onto the market. I have recently seen many professional quality games that I believe are worthy of praise. The most notable of these are *Doodle Bug*, *Starfire*, and *3-D Brickaway.*

Doodle Bug

In *Doodle Bug*, you move a hungry ladybug through a maze lined with dots while avoiding the predatory insects. Sounds a lot like Pac-Man, right? Well it is, and it isn't. The main difference between Pac-Man and *Doodle Bug* is that the former doesn't have rotating turnstiles. And what a difference they make!

Doodle Bug is an adaptation of LadyBug, a coin-op arcade game by Universal. The object of *Doodle Bug* is to clean out maze after maze of dots. There are other special elements scattered randomly in the corridors that can bring extra points of death. These include: hearts, letters, and skulls.

Doodle Bug is controlled with the joystick, and responds remarkably well to the slightest movement of the stick. After you have the game loaded and running, you never have to touch the keyboard unless you want to freeze the action, or abort the game in play.

One thing I really like about *Doodle Bug* is that the computer screen actually looks like a real arcade game, rather than a computer adaptation. *Doodle Bug* features four colors, and the highest resolution graphics I have seen on any Color Computer game. The graphics are very detailed, but the animation of the bugs is slightly jumpy.

One or two people can compete for high scores. Using the right joystick, you choose the number (3-6) of ladybugs with which you wish to begin the game. This allows for both long and short games.

creative computing
SOFTWARE PROFILE
Name: Doodle Bug
Type: Arcade
System: 16K TRS-80 Color Computer
Format: Tape/disk
Language: Assembly
Summary: Adaptation of LadyBug, coin-op game from Universal
Price: $24.95/$29.95
Manufacturer:
Computerware
4403 Manchester Ave., Box 668
Encinitas, CA 92024
(714) 436-3512

David Crandall, author of *Doodle Bug*, has done an excellent job of converting LadyBug to the Color Computer. The only change I would like to see made would be to have the aggressive bugs become quicker as the game goes on as they do in the arcade game. As it stands now, the speed of all of the elements remains constant throughout the game. Nevertheless, *Doodle Bug* is challenging and a very good buy.

Starfire

Starfire is a colorful machine language game that combines hi-res graphics and interesting sound effects to create a very playable Color Computer version of the popular arcade game Defender. For the benefit of anyone unfamiliar with Defender, a brief description is in order.

In *Starfire*, as in Defender, you guide a multi-directional space fighter over the surface of an alien planet. Your goal is to protect the helpless people who pepper the planet's surface.

Although the packaging of the software is rather poor, it does not reflect the quality of the game itself. Included with the tape or disk is a single page of documentation which describes the controls, explains loading instructions, and gives strategy hints.

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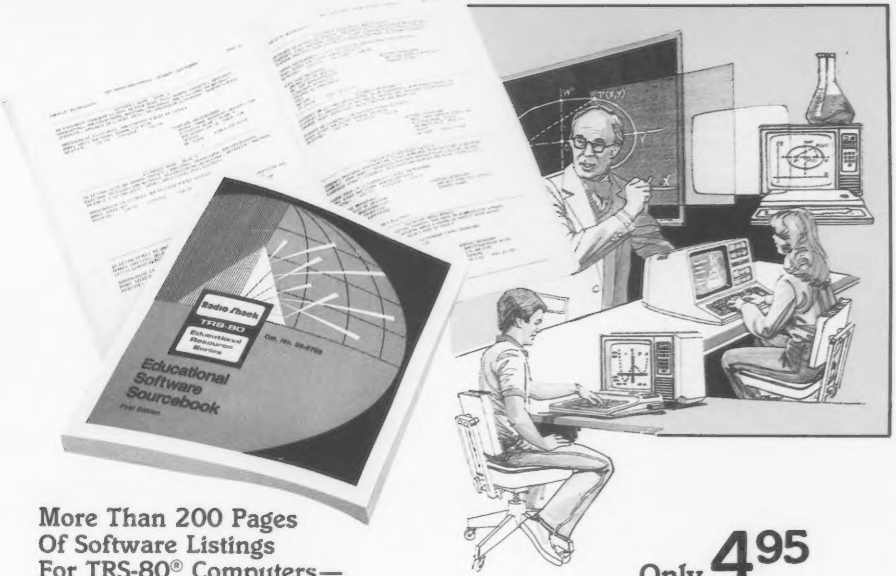

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Color Computer Games, Continued...

Starfire uses keyboard controls. Some of the other Color Computer versions of Defender I have seen use the joystick and all of them are much more difficult to control. If a coin-op game uses buttons, then the computer adaptation should use the keyboard, rather than the imprecise Radio Shack joysticks. The only problem with the keyboard controls is that the up and down keys (2 and Z) are too far apart.

creative computing
SOFTWARE PROFILE
Name: Starfire
Type: Arcade
System: 16K TRS-80 Color Computer
Format: Tape/disk
Language: Assembly
Summary: Adaptation of Defender, coin-op game.
Price: $21.95/$26.95
Manufacturer:
Intellitronics
22 Churchill Lane
Smithtown, NY 11787
(516) 543-6642

The screen consists of three separate displays. In the upper left-hand corner is the score box. In addition to the on-screen scoring, there is a graphic display of the number of ships and smart bombs you have left. Located in the upper right is a small radar screen to help you plan your assault on the aliens before they show up on your viewer.

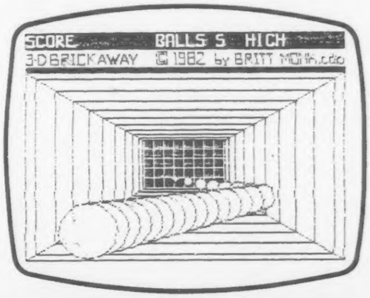
The main portion of the screen is devoted to the playfield. On the playfield you see your ship, the ground below, and any invaders that happen to be within firing distance. The scrolling of the landscape is extremely smooth and the alien movements are equally non-jumpy.

Starfire is an excellent adaptation of Williams's arcade classic. If you enjoy Defender, then this program is for you. I am pleased to report that *Starfire* is one of the first programs that uses all of the neat functions of the TRS-80 Color Computer. I hope that Intellitronics will introduce more games of this high standard. I truly enjoyed "reviewing" this game, and I suspect you will be equally pleased.

3-D Brickaway

Soon after joining the local YMCA last year, I took up a new sport, racquetball. Ever since I began playing, I have wondered if it would be possible to write a computerized game of racquetball. My question has been answered. *3-D Brickaway* is a variation of Breakout that is very similar to a single-player racquetball game.

The computer screen shows a three-dimensional view of five walls. The wall at the far end of the court is broken up into 40 tiles that must be knocked out. You begin each game with five balls. Pressing the fire button on the joystick places a ball into play.



As the ball travels downcourt, its size decreases, giving the illusion of depth. When the ball hits a wall, it bounces off at logical angles. If the ball strikes a filled-in portion of the back wall, that tile is knocked out.

creative computing
SOFTWARE PROFILE
Name: 3-D Brickaway
Type: Arcade/simulation
System: 16K TRS-80 Color Computer
Format: Tape
Language: Assembly
Summary: Computerized racquetball
Price: $14
Manufacturer:
Britt Monk, CDP
Box 802
Elyria, OH 44036

To hit the ball, you must manage to keep it in sight through the racquet. If you can do this, you will never have a problem returning the ball. There are two ways to hit the ball: simple deflection and power hit. A simple deflection occurs when the ball hits the paddle and bounces off wildly. For a power hit, you must have the fire button depressed. If you do this, you have more control of the ball, but its velocity increases.

The graphics in *3-D Brickaway* are high-resolution, but not very colorful. The movement of the ball is not as smooth as it could be; this is a case in which graphics were sacrificed for

DARK HORSE?

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playability. The paddle responds quickly to the joystick controls, allowing you to get from one corner of the screen to the other in the blink of an eye.

3-D Brickaway is more than a game, it is an example of how three-dimensional graphics can be used on the Color Computer. The excitement of racquetball is lost in the translation from YMCA to computer screen, but *3-D Brickaway* is still a fun game to play and it is very reasonably priced.

Donkey King

In the world of arcade games, 1982 was the year of Donkey Kong. Virtually no computer or home video game system is without a program that resembles the original coin-op game. Now, from Tom Mix Software, there is *Donkey King* for the TRS-80 Color Computer.

After evaluating many programs that run on the TRS-80 Color Computer, I had concluded that, at best, the Color Computer was capable of playing only mediocre games; programs of redeeming entertainment values were few and far between. But *Donkey King* has changed all that. It is absolutely the best arcade game written for the Color Computer.

creative computing
SOFTWARE PROFILE

Name: Donkey King
Type: Arcade
System: 32K TRS-80 Color Computer
Format: Tape/disk
Language: Assembly
Summary: The best arcade game available for the TRS-80 CC
Price: $24.95/$27.95
Manufacturer:
Tom Mix Software
3424 College N.E.
Grand Rapids, MI 49505

In *Donkey King*, as in Donkey Kong, you portray Mario the Jumpman. It is your mission to rescue your girlfriend from the sinister clutches of a nasty ape. In your struggle to succeed, you must scuffle about on metal skyscrapers, jump elevators, and avoid fireballs. The path to the top is a hard one indeed.

Donkey King takes up a tremendous amount of memory (32K). This is because it has all four screens, like the original coin-op game, in one large program. The popular ColecoVision cartridge of *Donkey Kong* has only the first three screens. Not only does *Donkey King* have all of the boards, it presents them in the same sequence in which they appear in the coin-op game.

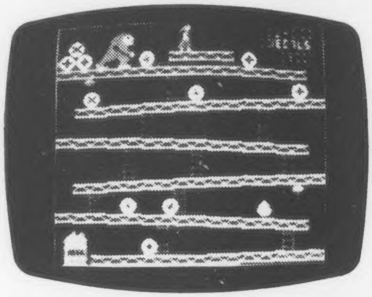
One or two players can compete alternating turns. There are two game modes: regular and practice. If you choose the standard game, you begin with three men at your command. The practice mode gives you 12 lives. This may seem like a lot, but believe me, they sure don't last long.

The screens are almost identical to those of Donkey Kong, and the game plays similarly. Moving your joystick causes Mario to move around, and pressing the action button makes him jump in the direction he was running. *Donkey King* is one of the only Color Computer games that effectively uses the unfortunate Radio Shack joystick controllers.

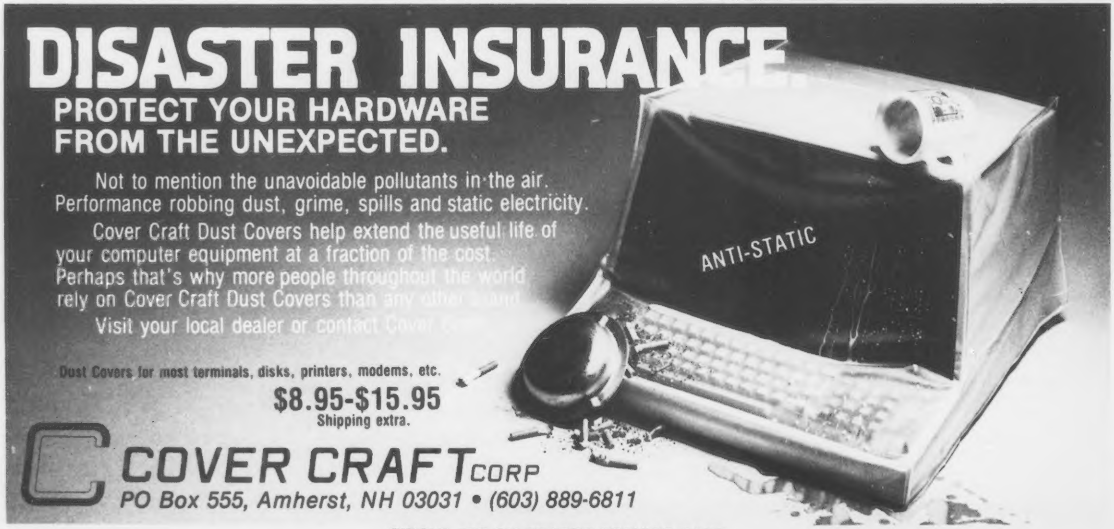
The graphics of *Donkey King* are hi-res and about as colorful as any Color Computer game on the market. The animation of the elements is very professional—everything moves smoothly with very little flickering.

Donkey King has everything the arcade game has except an "insert coin" message. The sound effects are very good for the Color Computer, and every audio effect of the video game has been woven into this impressive program.

The one complaint I have about the game is that it becomes far too difficult too quickly. I have played many games in the practice mode, and rarely do I get to the fourth and final board (keep in mind that you get 12 men in the practice mode). The program would be greatly enhanced by selectable difficulty levels. As it stands, you often feel that your demise was not the direct result of your actions, but rather of the cruelty of the program.



It is difficult for me to communicate just how impressive *Donkey King* is. If I had to pick one program to show off the Color Computer, *Donkey King* would be it. If you call yourself a serious gameplayer, you can't afford to be without *Donkey King*—it alone sits on the game software throne. ☐



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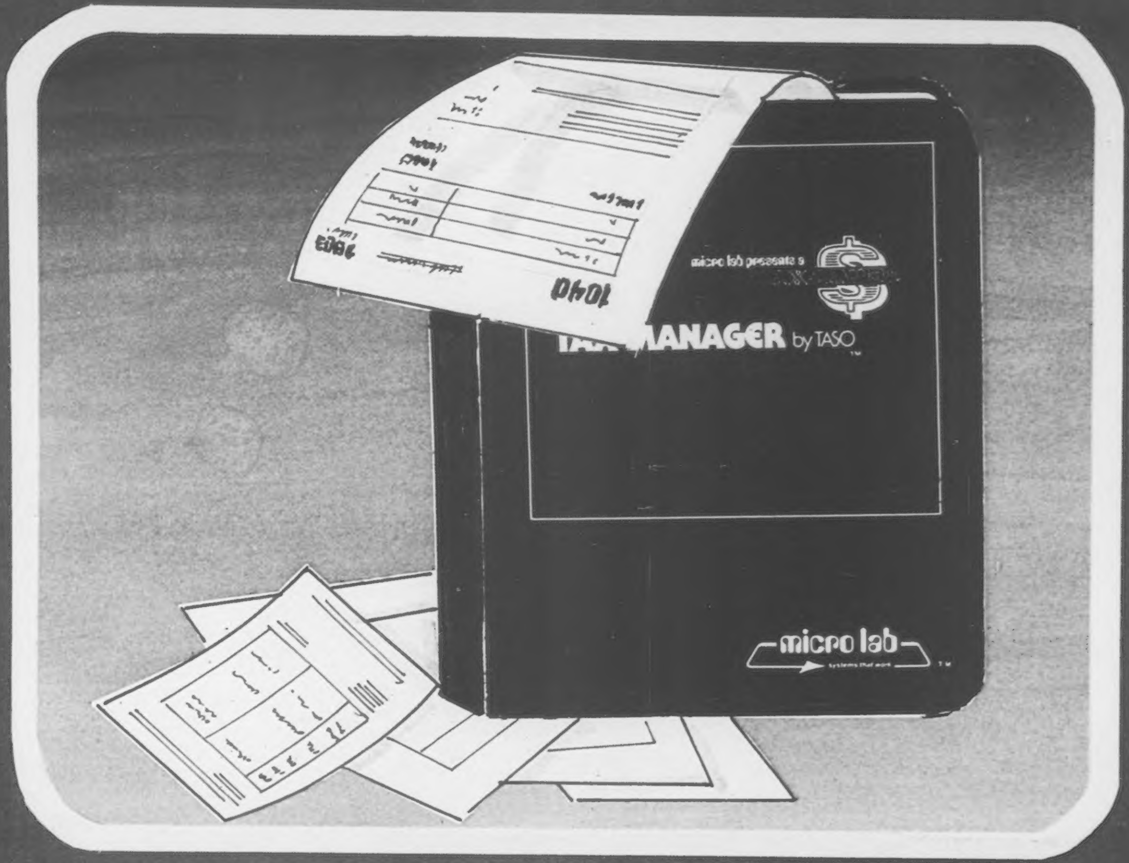

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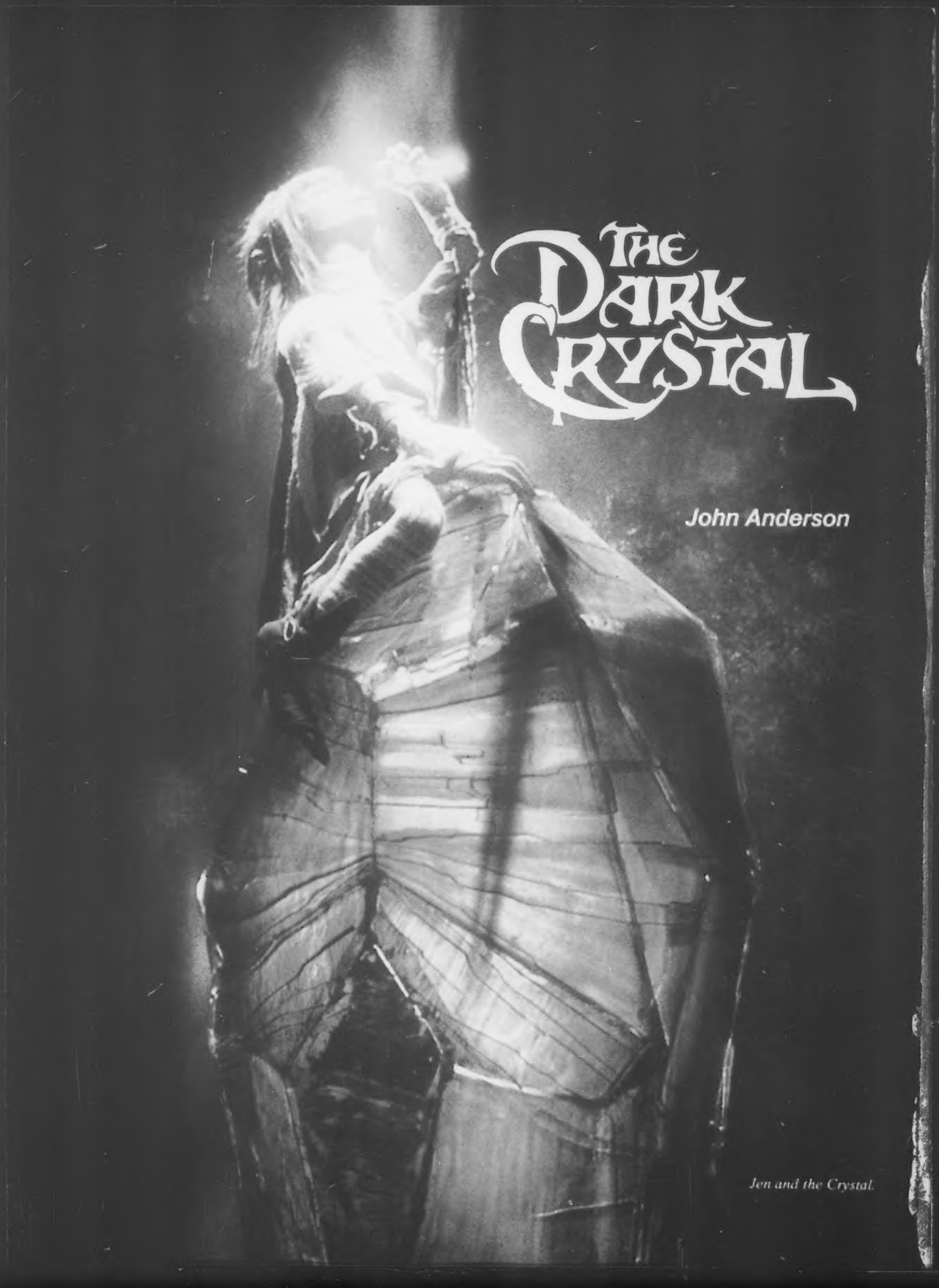
THE DARK CRYSTAL

John Anderson



Jen and the Crystal.

Dark Crystal is an amazing amalgam. Though it is an original, it doubtless shares elements of Lucas' *Star Wars,* Williams' *Masquerade,* and Tolkien's *Lord of the Rings.* It is fantasy adventure and mythic fable; it is the story both of a world and of a boy. It is a film, a microcomputer program, a record, at least three books, toys, even fashions. Oh yes, and it is the latest gift from the main Muppet at Muppet control, Jim Henson.

Who is better qualified, when you come right down to it, to bring a full-fledged fantasy adventure to a mass audience than Jim Henson, Frank Oz, and the other inspired folks who have been packaging fantasy for years now? That they are puppeteers is certainly true, but it is less than the whole truth. They are illusionists, purveyors of pretending, and they focus all their energies on bringing rich imaginary worlds to utter, teeming, show-stopping life.

Henson claims that the project has been in some stage of development for the past five years, but I know better. I can clearly trace its inception to an extremely motley gaggle of monsters, more seedy than scary, an unnamed troupe I can only describe as the "Not Ready for Prime-Time Muppets." They occasionally inhabited the old *Saturday Night Live* program in its heydey (when it was funny), back in 1975 or so. In the few moments per episode they appeared, they invariably stole the show.

The leader of the group was Scred, a snaggle-toothed, baggy-eyed reptile of indiscriminate origins, who looked for all the world like he had smoked too many insects before going on. His world was one of fractured myth, where stone idols shrugged in embarrassed indifference, while helmeted sidekicks evoked peculiar Norse legends. Beside his charismatic anti-hero personality, the most magnetic thing about Scred was his gaze: his eyeballs were positively *real.* And this was a germ of things to come, a breakthrough of sorts. Scred's eyes were not of felt or plastic, but rather of glass; they had come from a taxidermist.

The legacy of Scred lives on in the icky Skeksis of the *Dark Crystal,* from the reptilian gaze to the "sk" sound in their names. And for all his seventies cynicism, Scred should be very proud to have figured into the ancestry of such a project.

In 1977, Henson took another step toward realizing his ambitious goal. He became aware of the work of fantasy artist Brian Froud, and was immediately convinced that Froud was the only person who could bring to fruition the characters and world growing in Henson's mind. Froud saw that Henson was the one person who could imbue Froud's creations with *life.* And so a fortuitous partnership was met—one that I hope will not be disbanded for some time to come.

Another milestone for the project can be accurately marked in 1979, when Frank Oz brought the character of Yoda to *The Empire Strikes Back.* This partnership brought Henson Associates into contact with Gary Kurtz, producer of the *Star Wars* films, and now of *Dark Crystal.* In the following year, when Yoda proved to be not only the major star of *Empire* but the most bankable star in Hollywood, it became apparent that audiences were ready for the kind of fantasy Henson wanted to provide. Another upstartish director also took note of this: Steven Spielberg. He made *E.T.* into the Yoda of '82—in fact, he even acknowledges his debt in the film.

Jen and a Mystic.

© Henson Assoc. Inc. 1982

Henson's philosophic underpinning is not mysterious. He states it in rather straightforward terms through his alterego, Kermit, at the climax of *The Muppet Movie.* Though I cannot remember the exact lyrics of the finale, the gist is along the following lines: "Hey," Kermit says, "you've been watching a bunch of felt, wire, and trickery for the past two hours, and were swept into what you saw. This is important, because it proves that you can still pretend, and that is something we should always be able to do. That is what keeps us young."

Nestled, one might even say *camouflaged,* unobtrusively in a fashionable cluster of townhouses on New York's Upper East Side, is the home of Henson Associates. The location fits perfectly into the Muppet scheme of things, and has successfully made the transition from opulent mansion to vital, inviting workplace. There I met with the Henson folks, along with Chris Cerf and Roberta and Ken Williams, to talk about the microcomputer version of *Dark Crystal.*

Hobby microcomputerists are by and large no strangers to adventure fantasy; for some, it is the prevalent type of program run on their machines. I wrote about technical advances in the graphic adventure in the August 1982 issue of *Creative Computing.* While the microcomputer adventure is still not quite as popular as other fictional forms, I assert that it is only a matter of time until it emerges alongside the novel, short story, and film as a storytelling medium. You heard it here first, folks.

Further, it will flourish due to its unique, involving, interactive nature. You do not merely observe the action, you are a part of it. Your decisions affect the outcome. Your actions count.

Ken and Roberta Williams, the driving force behind Sierra On-Line, are no strangers to the adventure form either. They developed some of its most popular titles, including *Wizard and the Princess,* and the epic *Time Zone,* which has already achieved classic status. Nor is Chris Cerf a novice. He is the writer, publisher, and microcomputer afficionado who has worked with Roberta to develop the graphic adventure *Dark Crystal.*

Don't misunderstand. I'm not saying that computer games using the names and some imagery from popular films are a new thing. But all of the stuff we've seen so far has come out long after the fact, and has built an arcade-style "twitch" game out of a few concepts from a film. *Dark Crystal* is the first work to be released simultaneously as film and computer program; and is the

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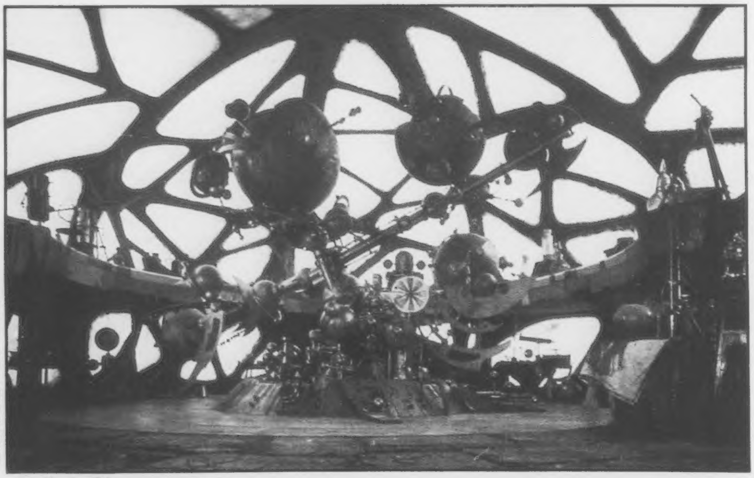
The author wishes to extend his gratitude to Mary Ann Horstmeyer and Maureen Ruddy of Henson Associates for their gracious help.



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Aughra's Observatory.

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Historian Skeksis.

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Jen and the Skeksis Chamberlain.

first computer adventure to be based on a feature film.

The Plot Thickens

The *Dark Crystal* is sure to gain cult status in short order. It is the story of a world with three suns, a world once inhabited by three races: the urSkeks, the Gelfings, and the Pod people. They coexisted peacefully and productively, governed by a huge, glowing crystal, which ensured their well-being.

Every thousand years the three suns would come together, and a kind of rebirth would take place in the light of a Great Conjunction. But something happened a thousand years ago, at the time of the last conjunction. The urSkeks schizophrenically split into two separate and opposite beings: the urRu—wise, if passive philosophers—and the Skeksis—evil, monstrous tyrants. The Skeksis seized control of the Crystal, and with it, control of the planet. A piece of the crystal itself broke off, and the remaining part darkened. Gelfling prophecy held that the missing shard could be replaced only during the next conjunction, and only by a Gelfling, if the Skeksis were to be destroyed. They would otherwise rule forever.

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Aughra, Keeper of Secrets.

The Skeksis took what they saw to be positive action to defuse the prophecy: they undertook to kill every Gelfling on the planet. And they very nearly succeeded. With the exception of Jen, raised by the urRu, and Kira, raised by the Pod People, every Gelfling on the planet was murdered. As the banquet scene will verify, the Skeksis simply aren't the kind of folks you invite for dinner.

Jen, of course, is the great Gelfling hope, and with Kira's help, attempts to realize the ancient prophecy. They en-

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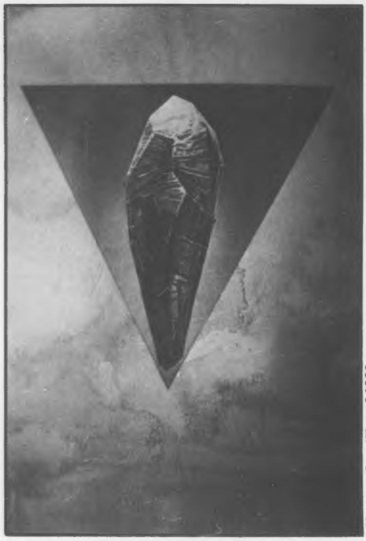
The Dark Crystal by Brian Froud.

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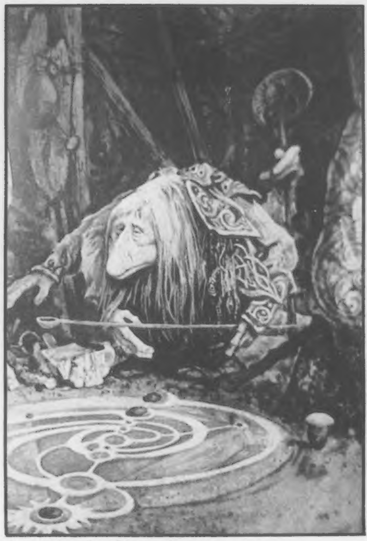
An urRu by Brian Froud.

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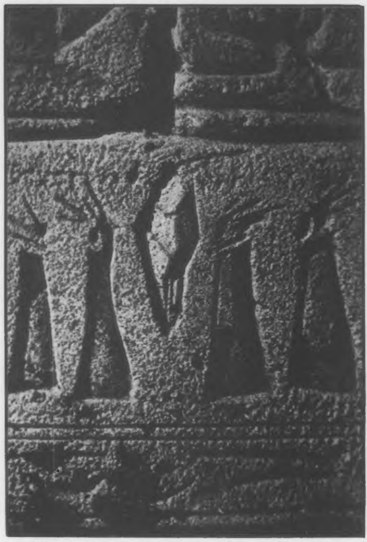
Gelfling Heiroglyphs by Brian Froud.

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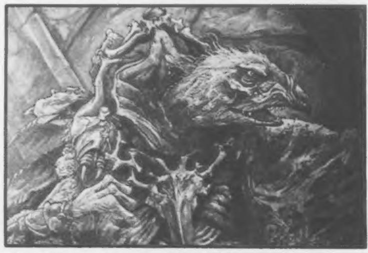
counter many strange beings, as well as puzzles, dangers, and mysteries en route.

One of these is Aughra, the sorceress, played by Frank Oz. Oz has emerged as perhaps an even more phenomenal puppeteer than Henson himself. His characterizations of Miss Piggy and Fozzy Bear have brought the name Oz a new meaning worldwide. When Yoda's nose twitched reflexively, when his brow crinkled in thought, Frank Oz was plying his trade.

Henson and Froud have worked to present a world as rich in complexity and detail as possible. Some shots of only seconds in length took days to produce. This is what makes the world of the *Dark Crystal* truly a *world.* The same kind of magic that brought you Kermit on a bicycle and Fozzy at the wheel, here brings you good versus evil on a grand scale.


SkekUng the Garthim-Master by Froud.

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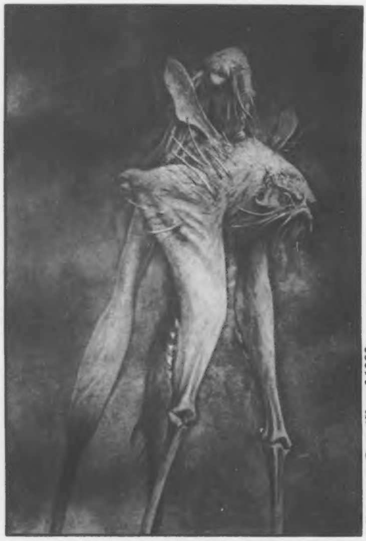
The microcomputer adventure version of the *Dark Crystal* takes place in exactly this same world, though some very new challenges are offered. You are Jen, and your goal is restoration of the crystal. Knowledge of the film will help you along the way, but the action has new depths and new levels of complexity. Certainly the richness of detail that the film affords will heighten the sense of magic you experience while playing the computer version.

Creating graphic adventures has be-


Kira on a Landstrider by Froud.

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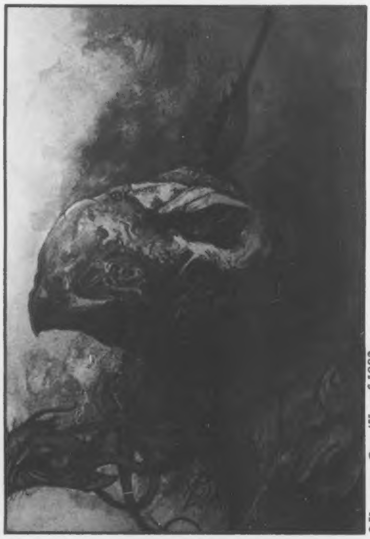
SkekZok the Ritual-Master by Froud.

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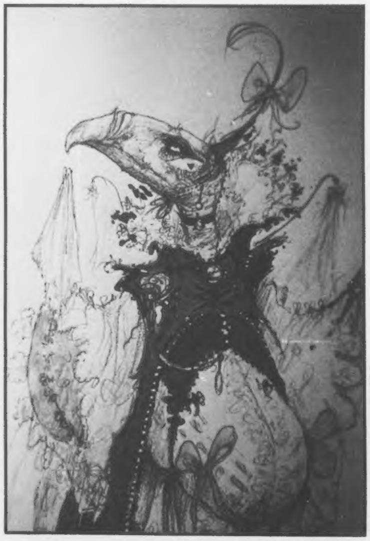
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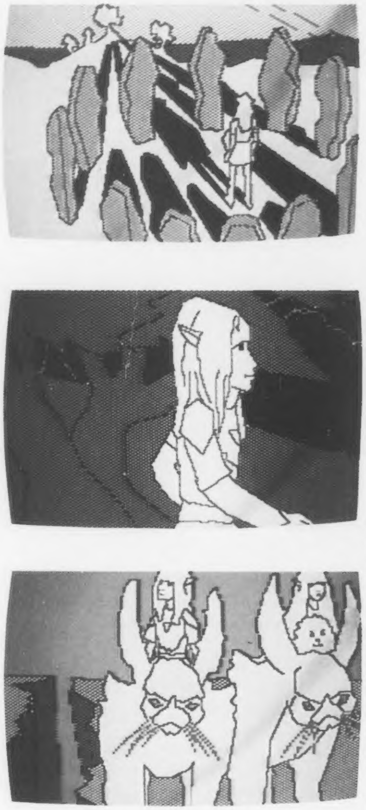
Ken and Roberta Williams.

come nearly second nature for Roberta Williams. The *Dark Crystal* project took her a little over a month. "It was easier because the map was mostly already there," she says, "though we've added some surprises." Asking her what comes first in game development is like asking about chickens and eggs. "It evolves as I'm building it. New possibilities always pop up. The toughest thing sometimes is deciding what to put in and what to leave out, because so much could be there."

Roberta works all her plans out on paper—sometimes huge sheets of wrapping paper—with all sorts of notes heading off in all sorts of directions. No other human being can make much out of what is there—not without training, anyway. When I asked her why she didn't use a word processor or database package to help with game development, she chuckled. "I guess computers still intimidate me a little bit. I'd just rather work it out on paper."

Ken spoke of how a tiny family business has grown in three short years. "There was a time when the idea of hiring programmers just for translation would have been unthinkable. Right now we're putting a big emphasis on program translation," he says. "We intend *Dark Crystal* to be available for the Apple, Atari, IBM, and Commodore 64 machines. We are also translating many of our other popular games. The demand is there."


Preliminary screen art for the microcomputer adventure.

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Dark Crystal is destined to introduce thousands of computer users to the realm of the computer adventure. I cannot think of any collaboration that could have done nearly as well in the task. To the newcomers drawn to adventuring via *Dark Crystal:* Welcome, and hold on to your hats. The adventure has really just begun. ☐

Cerf's Up

Chris Cerf is a renaissance man. He is not only a writer, editor, and publisher (son of the late Bennett Cerf), but the man who got Jim Henson and Frank Oz excited about microcomputers. Both men told me of their interests in the field—Oz is close to purchasing a micro.

When you meet Chris, you realize how infectious his enthusiasm can be. As a frequent contributor of material for TV's *Sesame Street,* the possibilities of microcomputers in education look especially promising to him. As does the general literary potential of the medium.

"The adventure is a perfect way to get 'humanities types' into computers," he says. "Especially the ones lacking in hand-eye skills." One of his jobs at Henson is to act as a bridge between the raw talent on both philosophic banks of the river: those who are strong in programming, and those who are strong in verbal skills. "People like Roberta Williams are quite rare. Most adventures around today are turned out by folks who are programmers, not writers by any means. I'm working to change that."

"I'd like to coax some humor into the form as well," says Cerf. "The adventure can become a literary medium." He states that storyline, as well as sound and graphics in an adventure program, can achieve a sophistication far beyond anything yet seen.

This bodes well for education as well, according to Cerf. "Adventures prompt familiarity with the keyboard, with textual material, with creative problem-solving, as well as making the user feel a part of what is going on, rather than a mere observer."

He showed me some promising preliminary results of photographically digitized images, and predicted that the photographic approach would eventually replace the current "graphics tablet" approach to adventure graphics. It saves work, as original art can be digitized directly instead of being tediously redrawn. And the results can actually be superior. The current disadvantage is extra memory cost per image. Cerf is undaunted. "We'll get it right."

As for the place of the videodisc in all this, Cerf is only a bit less optimistic. He points out that the cost of mastering a disk remains prohibitive. "It will happen," he predicts. "But we may be talking about ten years from now."

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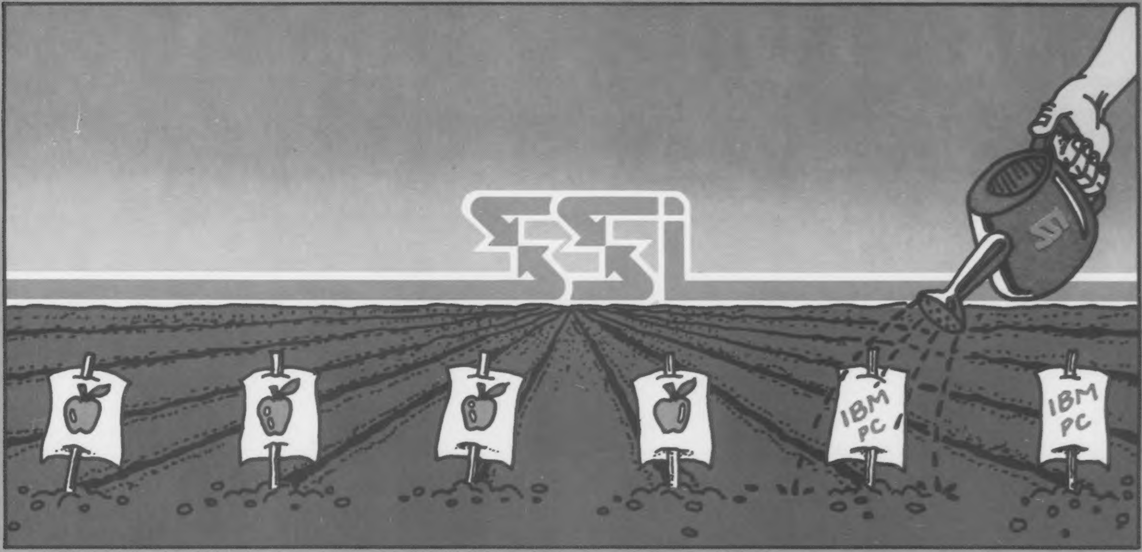

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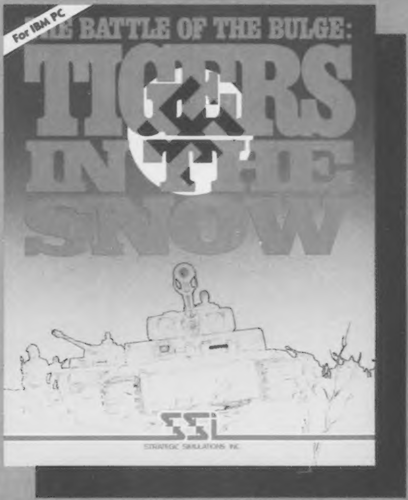

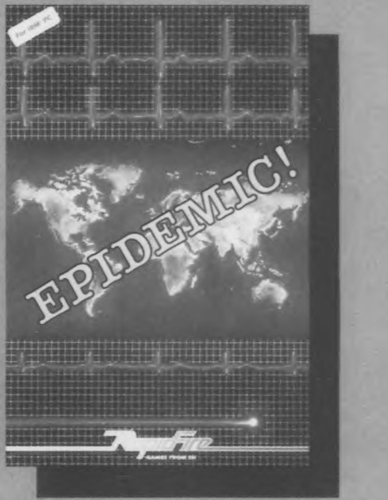

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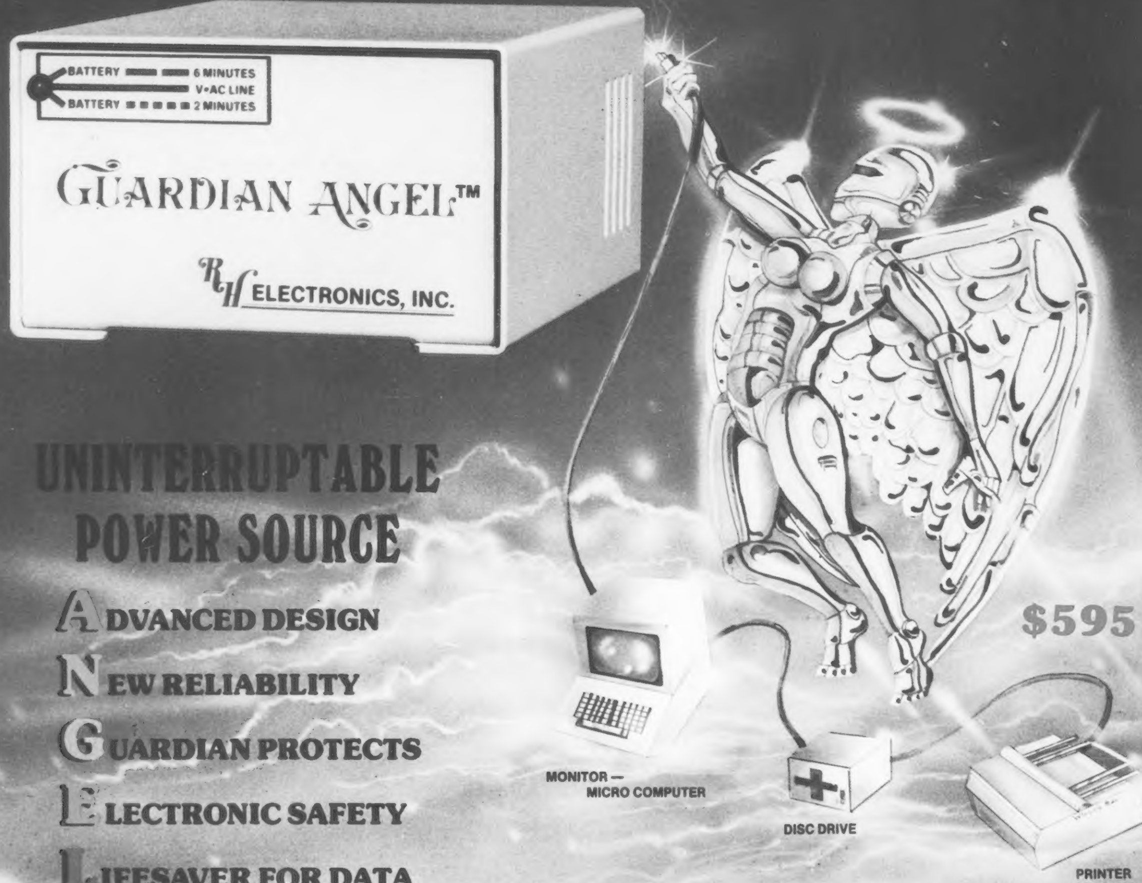

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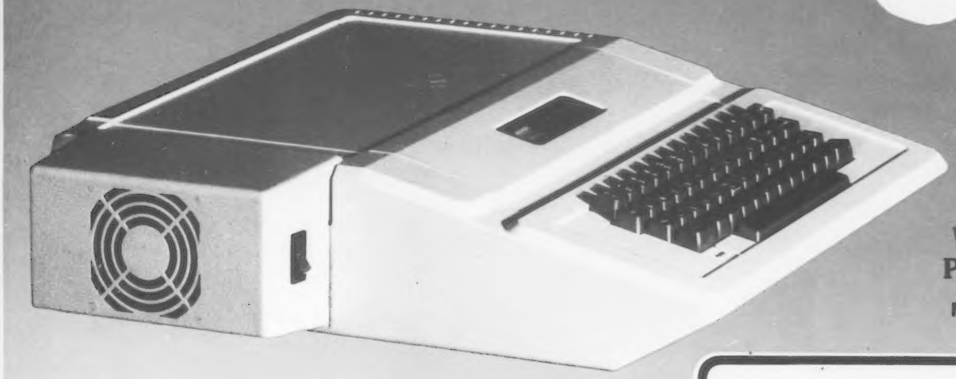

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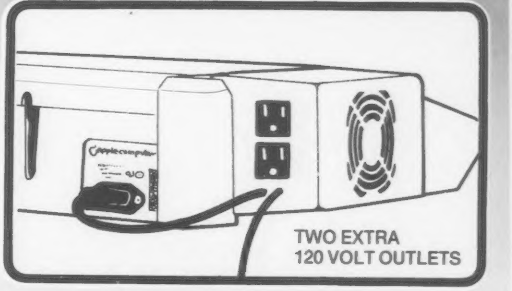

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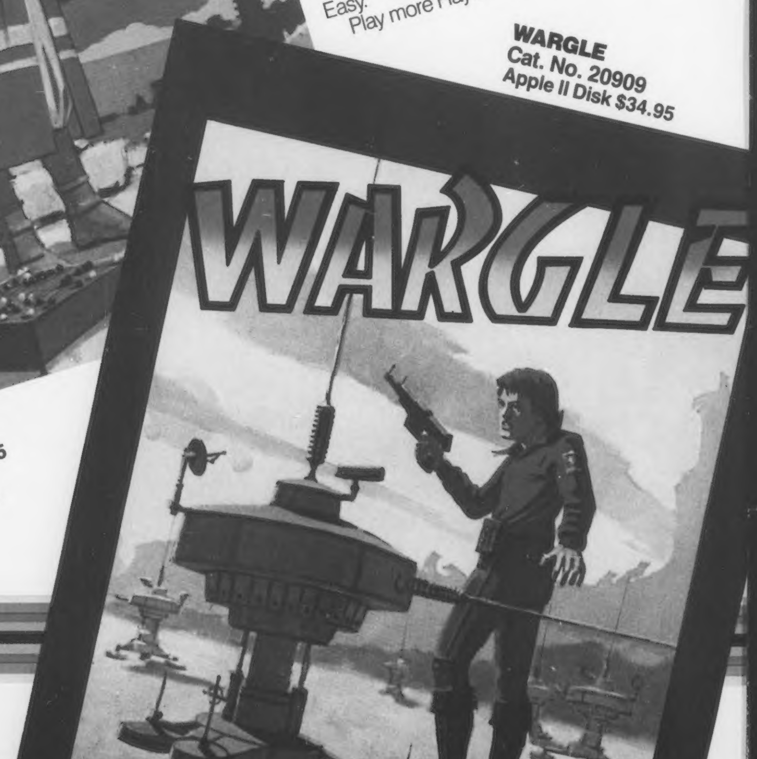

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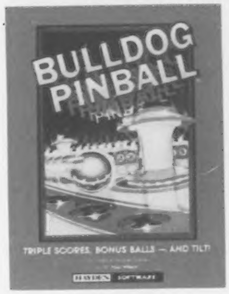
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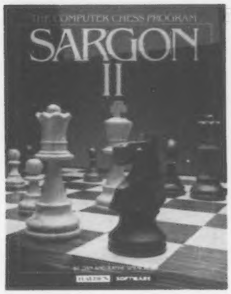
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Beyond Turtle Graphics

Donald T. Piele

When I run across an interesting computer program while browsing through the pages of a computer book or magazine, I often stop and wonder, "Yes, the program seems to work; it appears to be correct. But how can I write such a program myself?" Sometimes the author supplies hints on how the program works by identifying regions of the program where important things happen.

By studying other people's programs, I frequently pick up new programming strategies and techniques to tuck away for use at another time and place. The most important ideas are usually very simple and packaged in small bundles. They represent little kernels of code that handle some very big tasks.

Mathematicians create new structures in the same way. They approach problems by defining new objects, creating and proving small packages of relationships called *lemmas,* and then posing and proving new theorems by fitting the parts together. The primary reason that mathematics is considered a necessary component of formal education is that it teaches people to organize and attack problems in a structured way.

"Top Down" structured programming, which we hear so much about today in the context of computer programming, is not new at all to mathematicians. They have been doing it for centuries. Euclid's Elements, one of the greatest influences on the development of scientific thinking, is primarily known for its skillful selection of propositions and their arrangement into a logical order. Much of the material found in today's high school plane and solid geometry texts came from this work.

What is different today is that computers have dramatically expanded our options for teaching how to organize and solve problems in a structured way. We are beginning to see new languages and curriculum materials whose major function is to teach analytical reasoning skills through the use of structured programming exercises. One such language that has drawn considerable attention lately is Logo, which was developed under the direction of Seymour Papert at MIT.

Much has been written lately about the problem solving ability of Logo [3,4]. The emphasis in all of these writings is on teaching problem solving using Turtle graphics. There is no question about the effectiveness of Logo in this area. I have tried it, teachers have tried it, kids have tried it, and we all love it. But what is Logo like beyond Turtle graphics?

This month, I would like to examine a non-graphics problem using the Logo language. Armed with the Apple Logo reference manual and Harold Abelson's book, *Apple Logo,* I decided to tackle a problem involving the generation and display of factorials.

Small Factorials

The only place an exclamation point is used in mathematics is to indicate a factorial. For example, 4!, read as "factorial four," is defined to be the product 4x3x2x1, which equals 24. A deck of 52 cards can be dealt out in 52! or 80,658,175,170,943,878,571,660,636,856,403,766, 975,289,505,440,883,277,824,000,000,000,000 ways to be exact. How do you write a program to generate factorials?

Donald T. Piele, University of Wisconsin-Parkside, Box 2000, Kenosha, WI 53141.

Listing 1.

```
TO BEGIN                          TO LOOP :I
TYPE [ENTER A WHOLE NUMBER-]      MAKE "FACTORIAL :FACTORIAL * :I
MAKE "N  FIRST  READLIST          IF :I = :N  [PRINT :FACTORIAL
MAKE "FACTORIAL 1                                STOP]
(TYPE :N [!=])                    LOOP :I + 1
LOOP 1                            END
END
```

First examine the following Basic factorial program.

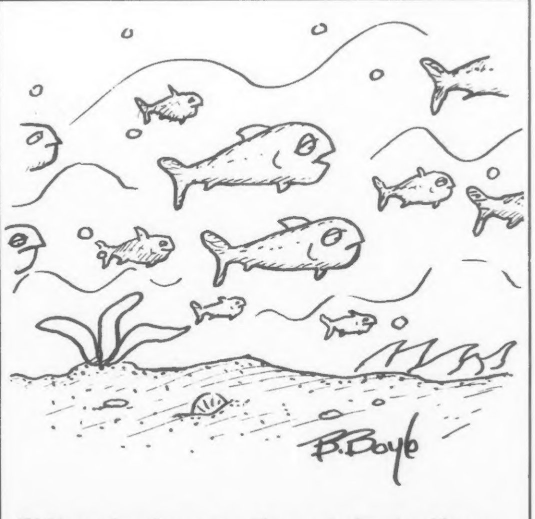
```
10 PRINT "SMALL FACTORIALS"
20 INPUT "ENTER A WHOLE NUMBER- ";N
30  FACTRIAL = 1
40   FOR I = 1 TO N
50    FACTRIAL = FACTRIAL*I
60   NEXT I
70 PRINT N;"!=";FACTRIAL
80 END
```

Type it in and run it for N = 12 and N=13.

```
SMALL FACTORIALS
ENTER A WHOLE NUMBER- 12

12!=479001600

ENTER A WHOLE NUMBER- 13

13!=6.2270208E+09
```

Notice that the above procedure has no provision for being precise beyond nine digits. This causes the switch to scientific notation between 12! and 13!. Try running the program for N=33 and N=34. On the Apple II you will set an overflow error for N=34 since 34! has more than 38 digits—the limit for real numbers in Applesoft.

Now let's take a look at the same problem solved in two different ways using Logo. The first program follows the same logic used in the Basic program. The second version is recursive. Two procedures need to be defined.



"If this one doesn't come up with computer learning aids soon, I'm switching schools."

The two procedures in Listing 1 are written in Apple Logo. The LOOP procedure is equivalent to lines 30 to 60 in the Basic program. Type in both procedures and then type BEGIN. Everything about the Logo program including the nine-place precision and the termination between 33! and 34! is identical to the Applesoft Basic program.

There is a better way to solve this problem in Logo by taking advantage of its natural recursive structure. A recursive procedure is one that calls itself. Factorials are easy to define recursively. For example if we set FACTORIAL (N) = N! then

```
FACTORIAL (N) = N x FACTORIAL (N-1)
```

and

```
FACTORIAL (1) = 1
```

completely define FACTORIAL (N). This procedure can be implemented in Logo as follows:

```
TO FACTORIAL :N
IF :N = 1 [OUTPUT 1 STOP]
OUTPUT :N * FACTORIAL :N - 1
END
```

Replace LOOP 1 in the BEGIN procedure with the line PRINT FACTORIAL :N. Now type BEGIN to use the recursive version.

Large Factorials

The built-in precision of Basic and Logo is not good enough to display all the digits in N! for large N. How can we correct this problem and generate large factorials with all their digits intact?

Let's begin by writing a Basic program that will print out N! for any whole number N up to 500. See Listing 2.

Listing 2.

```
 10 PRINT "LARGE FACTORIALS"
 20 INPUT "ENTER A WHOLE NUMBER ";N
 30 DIM A%(3*N)
 40   DIGIT = 1 : CARRY = 0
 50   A%(1)=1
 60    FOR I=2 TO N
 70      FOR J=1 TO DIGIT
 80        A%(J)=A%(J)*I + CARRY
 90        CARRY = INT(A%(J)/10)
100        A%(J)=A%(J) - 10 * CARRY
110      NEXT J

120    IF CARRY > 0 THEN C = INT(CARRY/10):
                          DIGIT=DIGIT + 1:
                          A%(DIGIT)=CARRY - 10*C:
                          CARRY = C: GOTO 120
130    CARRY = 0
140    NEXT I

145   PRINT N;"!=";
150   FOR I = DIGIT TO 1 STEP -1
160     PRINT A%(I);
170   NEXT I
180 END
```

The 68 digits (shown earlier) that constitute 52!, took about 45 seconds to generate with this program. The algorithm is exactly what one would use if one had to do it by hand with paper and pencil—simply multiply I * (I-1)! for I = 1 to N. The loop between lines 70 and 110 takes care of the digit by digit multiplication, keeping track of the quotients, the carries, and the remainders. The array A%( ) holds the digits of the current value of the factorial. The least significant digit is held in A%(1) and the most significant digit is in A%(DIGIT). The procedure in line 120 makes sure that the value of the carry does not get out of hand. Finally, lines 145 to 170 print out the digits of the answer in proper order.

Logo Version

Instead of defining arrays, Logo uses words. Table 1 shows exactly what response you get to the corresponding commands in Logo in the immediate mode.

Table 1.

Command	Response
`PRINT WORD 1 2`	12
`PRINT FIRST WORD 1 2`	1
`PRINT LAST  WORD 1 2`	2
`MAKE "A WORD 1 2`	
`PRINT :A`	12
`MAKE "A (WORD 1 2 3)`	
`PRINT :A`	123
`PRINT LAST :A`	3
`PRINT BUTLAST :A`	12
`PRINT LAST BUTLAST :A`	2
`PRINT 13 * 3`	39
`PRINT QUOTIENT 39 10`	3
`PRINT REMAINDER 39 10`	9

The digits of a large factorial can be stored together in proper order as a *word.* Each digit can be isolated with LAST BUTLAST; products can be formed with * and individual digits separated with QUOTIENT and REMAINDER. To solve the problem in Logo, break it up into the following five procedures; BEGIN, FACTORIAL, MULTIPLY, LONGHAND, and SOLUTION.

```
TO BEGIN
PRINT [LARGE FACTORIALS]
TYPE [ENTER A WHOLE NUMBER -]
MAKE "N FIRST READLIST
(TYPE :N [!=] FACTORIAL :N)
PRINT "
END
```

This procedure is the same one used in the limited version.

```
TO FACTORIAL :N
IF :N = 1 [OUTPUT 1 STOP]
OUTPUT MULTIPLY :N FACTORIAL :N - 1
END
```

This procedure is recursive and similar to the one used before. Now, however, the multiplication must be constructed—hence the procedure MULTIPLY.

```
TO MULTIPLY :N :B
MAKE "CARRY 0  MAKE "ANSWER "
OUTPUT LONGHAND :N :B
END
```

Each time we make a multiplication, we must start over with an empty answer and a zero for the carry. Now we are ready to perform the multiplication by LONGHAND.

```
TO LONGHAND :N :B
IF :B = " [OUTPUT SOLUTION STOP]
MAKE "TEMP :CARRY + :N * LAST :B
MAKE "CARRY QUOTIENT :TEMP 10
MAKE "DIGIT REMAINDER :TEMP 10
MAKE "ANSWER WORD :DIGIT :ANSWER
OUTPUT LONGHAND :N BUTLAST :B
END
```

The last step in each multiplication is to add on any carry that occurs in the multiplication of the most significant digit (the one to the extreme left). This leads us to the SOLUTION.

```
TO SOLUTION
IF :CARRY = 0 [OUTPUT :ANSWER STOP]
MAKE "ANSWER WORD :CARRY :ANSWER
OUTPUT :ANSWER
END
```

If we type in these procedures, then type BEGIN, and finally enter the whole number 52, it takes 2 minutes and 45 seconds to compute 52!. Try it!

Factorial Oddities

One of the reasons that I picked the multiple precision factorial problem for investigation was the intriguing designs that can be made with them. In Martin Gardner's book, *Mathematical Magic Show [2],* a chapter is devoted to factorial designs printed out in the shape of triangles, hexagons, and octagons. For example, 105! has 169 digits in the answer which can be displayed in triangular form.

```
105!=                 1
                     081
                    39675
                   8240290
                  900504101
                 30580032964
                9720646107774
               902579144176636
              57322653190990515
             3326984536526808240
            339776398934872029657
           99387290781343681609728
          0000000000000000000000000
```

Obviously, only certain factorials can be displayed this way. Which ones are they? If the number of digits in the factorial is a perfect square then it can be printed as a triangle. The factorial for 105 has 169 digits which is a perfect square (169 = 13*13). Other factorials whose digital count is a perfect square are listed in Table 2.

Table 2.

Factorials	7	12	18	32	59	81	105	132	228	..
Number of Digits	4	9	16	36	81	121	169	225	441	..

What changes are necessary to the Basic program to print out factorials in triangular form? Here is one way to figure it.

First, compute the place where a line feed is needed. It is necessary after printing a single digit and then after printing three more, five more, seven more and so on. This can be handled with a simple loop that counts up to 2*ROW - 1 for each row.

Second, use the ROW number in tabbing over the correct number of places, HTAB 20 - ROW. The following changes to the printout routine of the Basic program will do the trick.

```
148 I=0
150 FOR ROW = 1 TO N
160   HTAB 20 - ROW
170     FOR J=1 TO 2*ROW - 1
180        I=I+1
190        PRINT A%(D-I+1);
200           IF I=D THEN END
210     NEXT J
220   PRINT
230 NEXT ROW
```

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How to Solve It, continued...

Of course the 20 in HTAB 20 - ROW is designed to handle factorials up to 40 rows long. By the way, it took 3 minutes and 45 seconds to compute 105! in Basic.

Logo's Turn

There are no built-in formatting procedures in Logo. You must create your own. I broke the problem down into three procedures: PRINTOUT, HTAB, AND PRINTROW.

```
TO PRINTOUT :SOLUTION :ROW
IF :SOLUTION = " [PRINT " STOP]
HTAB 20 -:ROW
PRINTROW (2 * :ROW) - 1
PRINTOUT :SOLUTION :ROW + 1
```

Again, printing out the triangles requires tabbing over 20 - :ROW for each row and then printing (2 * :ROW) - 1 digits from the solution. To do this we must know how to HTAB.

```
TO HTAB :X
IF :X = 0 [TYPE " STOP]
TYPE "\
HTAB :X - 1
END
```

This procedure is equivalent to the Applesoft HTAB command. The third line (TYPE "\) must be typed in as

```
TYPE "<control Q>< >.
```

This means that after the quote sign, type the Q with the control key down and then make one space with the space bar. The last procedure is PRINTROW.

```
TO PRINTROW :X
IF :X = 0 [PRINT " STOP]
IF :SOLUTION = " [PRINT " STOP]
TYPE FIRST :SOLUTION
MAKE "SOLUTION BUTFIRST :SOLUTION
PRINTROW :X - 1
END
```

This procedure is needed to printout out the digits in each row.

We are now ready to incorporate the PRINTOUT procedure into the previous procedures used for generating the factorials. To do this we need to change two lines in the BEGIN procedure.

```
TO BEGIN              becomes   TO BEGIN
..........                      ............
..........                      ...........
(TYPE :N [!=] FACTORIAL :N)     (PRINT :N [!=])
PRINT "                         PRINTOUT FACTORIAL :N  1
..........                      ......
```

Type in these procedures and then BEGIN again. If you want to see the printout of 105!, it will take 21 minutes.

Conclusion

One can expect, as a matter of course, that learning a new computer language will take some time. This was certainly true in my case, because I spent the better part of two days working through the Logo procedures to be able to compute and display large factorials. This was a little surprising to me since my experience with the Turtle graphics portion of Logo had been so easy. Even young children find the Logo Turtle graphics easy to use. Beyond Turtle graphics is a different story.

In the introduction to Abelson's book, he writes, "Logo's designers are guided by the vision of an educational tool with no threshold and no ceiling. We try to make it possible for even young children to control the computer in self-directed ways, even at their very first exposure to Logo. At the same time, we believe that Logo should be a general purpose programming system of considerable power and wealth of expression. In fact, we regard these two goals as complementary rather than conflicting, since it is the very lack of expressive power of primitive languages such as Basic that makes it difficult for beginners to write simple programs that do interesting things."

I am just a beginner with the Logo language and clearly have much to learn yet, but, beyond Turtle graphics, I certainly cannot agree with Abelson's statement. This is the problem. People may assume, as I did, that since kids learn so quickly to work with Logo's Turtle that this ease will also hold for non-graphics problems. I have not found this to be true. Try it yourself with this or other non-graphics problems. Give it to your students to try.

The factorial problem is an example of only one out of five types that we typically place on the International Computer Solving Contest at the junior high level and above. The problems we create touch a wide range of computer problem solving skills which involve words, numbers, simulations, graphics, and puzzles. Teams of up to three students each have two hours to solve all five problems, using a computer language of their choice. On the basis of my experience with Logo thus far, I believe it would be very difficult to compete using Logo.

I want to conclude on a very positive note. I enjoyed working on this little problem solving exercise with Logo, and I intend to continue to solve other problems with Logo. I completely agree with the problem solving philosophy for which this language was developed and so eloquently expressed in Seymour Papert's book *Mindstorms* [3]. Finally, my mind is not made up. I only hope the experts will begin to show us how to use Logo beyond Turtle graphics.

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5. Weinreb, William. "Problem Solving with Logo," *Byte,* Vol. 7, No. 11, November 1982, pp. 118-134. ☐

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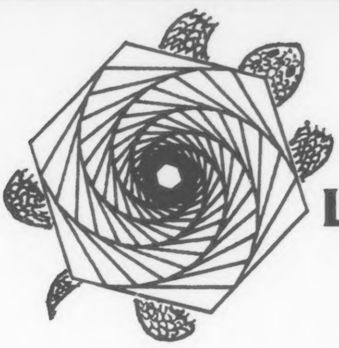

Logo Ideas

Robert Lawler

Different Kinds of Variables

If a variable is defined outside of a Logo procedure, its value can be changed by keyed commands or by executing any procedure which refers to it. Such a variable is called a Global variable. Now, if you store something in a box, generally you would like it to remain there until you change the contents of the box. You can't count on the contents of a global variable unless you take special care to guard against unexpected references. One way is to give your variables unusual names, e.g. [MAKE "GRANDMOTHER'S.SHIN.BONE 3]. The reason not to use unique variables is the difficulty of remembering what name you assigned. A second technique is to "initialize" every variable in every procedure before you refer to it. Doing this becomes a little tedious when you write lots of procedures. A third method is to use local variables.

Local variables are defined only within the context of the procedure which references them, so no procedure or keyboard entry can alter the value of another procedure's local variables. Further, local variables exist only within a specific execution (or "instantiation") of a defined procedure. This convention of the Logo language (and others as well) is central to the use of input variables (and others) in recursion. Consider the procedure below:

```
TO SQUARE :SIDES.LEFT
IF :SIDES.LEFT EQUAL 0 STOP
FORWARD 25 RIGHT 90
SQUARE :SIDES.LEFT - 1
end
```

When you key SQUARE 4, the Logo interpreter creates an instantiation or copy of the SQUARE procedure for execution. Let's refer to it as 1-SQUARE. The value of the corresponding variable 1-:SIDES-TO-GO is 4. When the third line of 1-SQUARE executes, the Logo interpreter creates a second copy of SQUARE; call it 2-SQUARE. What is the value of the corresponding variable 2-:SIDES-TO-GO? The answer is three. Executing 1-SQUARE, the Logo interpreter evaluates 1–:SIDES-TO-GO as 4 and subtracts one from it, then assigns 3 as the value for the variables 2-:SIDES-TO-GO. In successive recursions of SQUARE 4, this is what happens:

COPY	:SIDES.LEFT	ACTION
1-SQUARE	4	draw and turn
2-SQUARE	3	draw and turn
3-SQUARE	2	draw and turn
4-SQUARE	1	draw and turn
5-SQUARE	0	stop

The theoretician Dijkstra, inventor of the language Algol and one of the pioneers in the development of programming, said that once you understood how variables are used in programming, you understand the essence of programming. We believe he was referring to local variables as used in recursion when he said that. Understanding local variables has become more important in the world of systems and commercial programming as well with the use of "re-entrant" code in operating systems. Many such systems have extensive subroutine libraries. When these subroutines use local variables and observe other coding restrictions, they are re-entrant, which means they can be used simultaneously by several programs.

Variables and Abstraction

The Logo turtle can't deal with abstractions. It must go forward some specific amount or turn through some specific number of degrees. When you key FD :some-distance, the Logo interpreter evaluates the symbolic name "some-distance" (looks in the box or storage cell to determine its contents and substitutes that contents for the expression :some-distance).

People apparently can deal with abstractions, but find problem solving easier when they don't have to do so. Most often when a new procedure is being written, people use specific operand values, e.g. FD 100, which they later change to variable form, such as FD :some-distance. The nature of the abstraction involved is common to some other examples of mathematics as well.

The famous mathematician Bourbaki describes the creation of an axiomatic system as proceeding from the mathematician's working out a series of theorems with very concrete examples in mind and subsequently examining the inferences of his theorems to define precisely which characteristics of his examples were used by the theorems. In a third step, he redefines the set of objects to which his axioms apply as that most general class of objects having all those characteristics used in the theorems. That is, he bases his generalization on the operations he performed and not on a list of the characteristics of the example he began with.

We stress that the process through which a child generalizes a procedure after creating a concrete product with a concrete precursor, this child's play, is a particular kind of abstraction of value in the most intellectual endeavors as well.

This mathematical form of abstraction is called reflexive abstraction by Piaget, who sees the child creating his own mind through processes of thought that are like those of Bourbaki's mathematician. This points to the most significant potential impact of computer experience on children developing their minds. Reflexive abstraction may become more "natural" to them than what Piaget calls "Aristotelian abstraction" (abstraction by feature selection and classification) with which Piaget contrasts it. That is, children of the future may more often think like mathematicians than do children of today. ☐

Robert Lawler, Centre Mondial Informatique Et Resources Humaines, Paris, France.

Predicting the Future

Michael Crichton is a graduate of Harvard University and Harvard Medical School. He worked briefly in medical research while he pursued a hobby that was later to become his profession, writing.

The hallmark of his writing is meticulous attention to detail—he is sure of his facts, thus his stories are eminently believable. Who could doubt that The Great Train Robbery *and journey to Zinj (in* Congo*) really occurred, that a real* Terminal Man *was (or is) running around somewhere or that* The Andromeda Strain *is about to infest the earth?*

Crichton has turned his remarkable mind and energy in many directions—medicine, research, writing, filmmaking and, most recently toward personal computers. His approach to computerizing the prophecies of the I Ching presented here follow in his tradition of looking at a fascinating subject in meticulous detail with a liberal dose of technology and imagination thrown in. But this time the technology is real (a computer). As for imagination; well, see for yourself.—DHA

Michael Crichton, Constant C Productions, 1750
14th St., Suite C, Santa Monica, CA 90404.

Michael Crichton

Although it is at least 3000 years old, the I Ching, a Chinese method of divination, employs what we would now call a binary technique. In its simplest form, three coins are tossed six times to create a six-line figure of broken and unbroken lines. This so-called hexagram is then interpreted by consulting the I Ching, or Book of Changes.

Those who consider the methods of the I Ching sacred may find a computer a chilling perversion of ancient beliefs.

This Book is older than the Bible; tradition dates its origin to 1120 B.C., five hundred years before Confucius added his commentaries. Over the centuries the I Ching has been studied as a religious text and a philosophical masterpiece. But the I Ching is also unquestionably a method for predicting the future, and this aspect has received much attention during the twentieth century.

It is fundamental to the I Ching that the future can be understood in perpetually changing patterns of off/on, yes/no, heads/tails, broken/unbroken. This binary aspect suggests the ancient technique is highly appropriate for adaptation to a computer. One might say that the I Ching treats reality the same way a computer does.

This idea may horrify purists. Those who consider the methods of the I Ching sacred—properly conducted only with ritual, incense, meditation and the complex tossing of yarrow sticks—may find a computer a chilling perversion of ancient beliefs.

But in fact there is no agreement on what makes the system work. One modern expert, John Blofeld, while testifying to the power of I Ching, denies any comprehension of how it works. Thus it is perfectly possible that a computer could cast the I Ching effectively.

For instance, one idea of the way the I Ching works is that your unconscious knows, through psi phenomena, how the coins will turn up even before you throw them, although your conscious mind remains convinced the coin toss is "random." From this perspective, the I

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This is also a non-programmer's package, but oriented more toward computer artistry. It's also an ideal complement to ***The Complete Graphics System II.*** *It has a brush module that lets you "paint" using a joystick or* ***Apple Graphics Tablet,*** *with the screen as your canvas and a choice of 96 "brushes" and 108 blended colors. You can also magnify any portion of the screen 2 or 4 times for detail editing, perform mirror images, exchange colors, and move parts of pictures to other areas of the screen. Also included is a packing routine that lets you store more pictures on each disk.*

Although both ***Complete Graphics System II*** *and* ***Special Effects*** *are written for non-programmers, they are provided on unprotected disks, and instructions are included for using the graphics and machine language routines in your own programs.*

The Graphics Magician

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This one is written with the programmer in mind; for anyone who wants to put professional quality graphics in their own software. Fast machine language animation and picture drawing routines are included for use in your own programs, and they're extremely easy to use. Using the editors provided, you simply draw your own multicolored shapes, draw their paths, and combine up to 32 independent shapes with paths and starting locations. The result is a machine language animation file that you just add and control with your own program—it does all the graphics work for you! The adventure-game picture editor works the same way: just draw, save, and add the redraw routine to your program. It increases a disk's storage capacity from 12 pictures to hundreds. A tutorial manual is included with examples of controlling animated objects with joysticks, detecting collisions, and a multitude of other useful hints and examples. For samples of what can be done, see any of our game packages, including ***PIE MAN, Transylvania,*** *and* ***Spy's Demise,*** *as well as those from several other companies using* ***Graphics Magician*** *for the graphics in their software.*

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Instead of offering our own superlatives, we recommend that you read what others have said about our graphics products. Listed here are some of the reviews we've found, along with a few quotable quotes:

Graphics Magician

"recommended to anyone wanting to work with Apple's high resolution graphics for whatever purpose...definitely a program Apple users should have in their software library", ***Byte,*** *Nov. 82.*

"miraculous and marvelous," ***Creative Computing,*** *Jan. 83.*

"makes a graphics magician out of each and every Apple user", ***Softline,*** *May 82.*

Other reviews: ***Peelings II,*** *Sept-Oct 82.* ***Softalk,*** *May 82.*

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"The program earns its name...it brings together at a modest price so many different graphics tools.", ***Softalk,*** *July 81.*

"The three-dimensional utilities verge on the phenomenal", ***Creative Computing,*** *June 81.*

"provides capabilities that go beyond the wishful-thinking stage and painlessly use much of the Apple II graphics potential", ***Infoworld,*** *March 1, 1982.*

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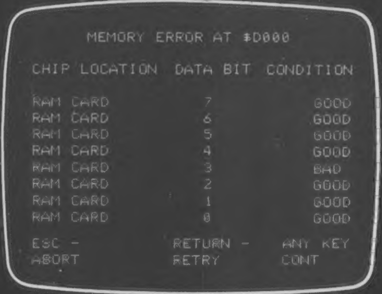

```
          MEMORY ERROR AT $D000

CHIP LOCATION  DATA BIT  CONDITION

RAM CARD           7          GOOD
RAM CARD           6          GOOD
RAM CARD           5          GOOD
RAM CARD           4          GOOD
RAM CARD           3          BAD
RAM CARD           2          GOOD
RAM CARD           1          GOOD
RAM CARD           0          GOOD

ESC -          RETURN -    ANY KEY
ABORT          RETRY       CONT
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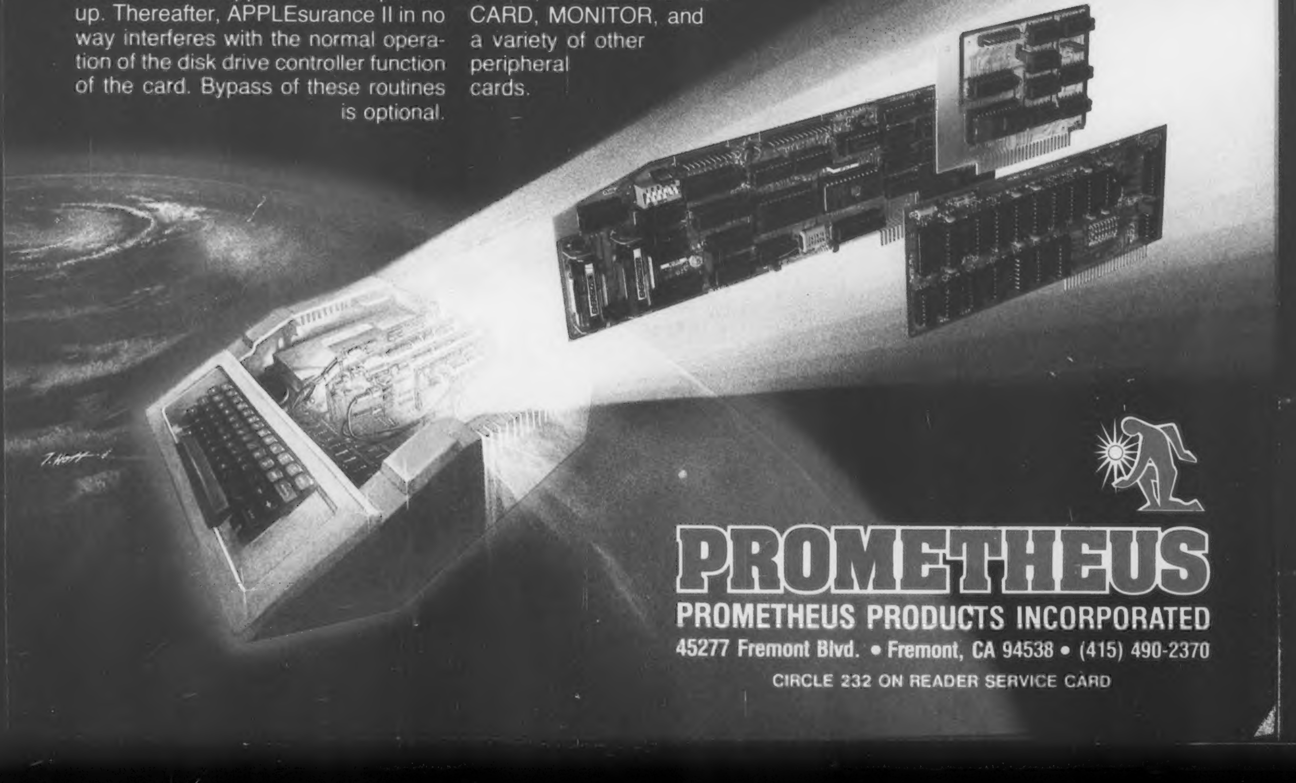

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CIRCLE 232 ON READER SERVICE CARD

Ching can be seen as a method of making you aware of what your unconscious is doing.

If this is true, your unconscious is also aware of multiple states of electronic interaction within the Apple computer as it cycles rapidly from one memory location to the next. You touch the keyboard according to some understanding your subconscious has of the state of the machine at that moment.

A more radical statement argues that your unconscious actually controls the outcome of the coin toss, or the state of the electrons within the computer. According to this idea, you touch the keyboard once you have made the state of the computer fit your subconscious wishes and desires.

These speculations are fun and intriguing. It was in the spirit of experimentation that the following program was written—and also in the spirit of laziness. For however one casts the I Ching, a good deal of bookwork is required. Line numbers for individual casts must be noted down; trigrams and hexagrams looked up in tables; derivative hexagrams generated. I find all this tedious, and I am prone to error in carrying it out.

How To Use The Program

The program allows the user to cast the I Ching with coins or with the random number generator of the computer itself.

If done with coins, three similar coins are selected. Heads are given a value of 2, and tails, 3. The coins are thrown and each throw is summed. If the throw is all heads, the sum is $2 + 2 + 2 = 6$. If the throw is two heads, one tails, it is 7; if two tails, one head, it is 8. If it is all tails, the sum is $3 + 3 + 3 = 9$. After each throw, the sum is entered into the computer, which checks to make sure the value is betweeen 6 and 9. After six entries, input stops.

The keyboard is used to cast by computer. Any key or keys can be pressed, at any time or in any order. After six key presses, input stops.

From this point the program proceeds quietly, without beeps or blinks, to generate the hexagrams and their titles. The primary hexagon is drawn, based on the numerical values of the six lines, reading from bottom to top. Pressing any key will add the hexagram number and name, as well as the line values from bottom to top.

An additional keypress creates all possible derivative hexagrams, and prints their hexagram numbers. One should note here that while all authorities agree on the validity of the secondary hexagram, and some agree on the validity of the first nuclear hexagram, the value of the second nuclear hexagram is controversial. Nevertheless, since some users of the I Ching employ it, I have included it.

A final keypress summarizes the information for the casting, provides a printout option, and ends the program. There is no loop back to run the program again—most users believe that the I Ching should not be thrown too often!

The program does not provide interpretation. To interpret the figures one must consult the Book of Changes itself. The most widely accepted reference is the Richard Wilhelm translation, published in the Bollingen Series by the Princeton University Press. (This program uses the hexagram names of the Wilhelm translation.)

A more modern, and excellent, text is *I Ching*, translated and edited by John Blofeld, available in Dutton paperback. Blofeld's text concentrates on divination, and is lively and interesting.

The oldest translation of the I Ching is by James Legge, a nineteenth century scholar. Re-issued in Bantam paperback, it is considered less satisfactory by many scholars, and is certainly more difficult to use.

Each text devotes several pages of discussion to each hexagram. The text also provides a detailed interpretation of each line of the hexagram. (Users should note that derived hexagrams are interpreted without reference to specific line numbers. One reads the line number notations for the primary hexagram only.)

How The Program Works

Initially, the program loads an array of 64 hexagrams and a lookup array to determine the hexagram number from the individual trigram pairs.

Lines 100-560 accept input from either coins or machine. Individual values are POKEd into specific memory locations.

Evaluation begins on line 600. A background is drawn in low-res graphics, and the lines are created by the subroutine at 2000.

To this point, the program is straightforward. But to look up the hexagram numbers, some intricacies must occur. By convention, each hexagram is divided into lower and upper three-line trigrams. Before defining the hexagram, these trigrams must be standardized with string subroutines. (For example, a trigram of three solid bars might represent numerical values of 999, 997, 977, 777, 779, 797, or 979. These seven possibilities must be set to a single standard value before looking the hexagram up in the table.) This standardization occurs in subroutines 2200 and 3000, which convert any three-line trigram to a single number from 1 to 8.

The standardized numerical values are then related to a look-up data table

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I Ching, continued...

Listing 1.

```
57    DIM I$(128) : FOR V = 1 to 128 : READ I$(V) : NEXT V
1370  REM   START INTERPRETATION HERE
1380  GET A$
1390  HOME : VTAB 5 : PRINT "INTERPRETATION OF PRIMARY
      HEXAGRAM"
1400  PRINT
1410  HA = H1 * 2 - 1 : HB = H1 * 2
1420  PRINT I$ (HA) : PRINT I$ (HB)
1430  GET A$
1440  HOME : VTAB 5 : PRINT "INTERPRETATION OF SECONDARY
      HEXAGRAM"
1450 HA = H2 * 2 - 1 : HB = H2 * 2
1460 PRINT I$ (HA) : PRINT I$ (HB)
1470 END
```

starting on line 3500 and the hexagram number obtained. Next, the corresponding response string is obtained from the data listing in lines 4000-4660, and the result sent to the screen. For the primary hexagram, this occurs on line 790.

Secondary and nuclear hexagrams are then generated according to accepted rules of transposition. These figures in turn are broken into their component trigrams, submitted to the standardizing string subroutines, and then read from the lookup and response tables.

Modifications To The Program

This program is long, and deletions are certainly possible. The instructions, which begin at line 6000, comprise roughly one fifth of the code. I wrote them elaborately to assist friends unfamiliar with the I Ching, but sophisticated users can shorten this section or eliminate it entirely.

If you want immediate identification of the original hexagram, delete line 690. If you agree with those scholars who consider the second nuclear hexagram a worthless artifact, make the following changes:

Delete 920-950
Delete 1170-1200
Change 1230 to HTAB 10: PRINT N1
Delete 1340-1350

And if you agree with the strict authorities who reject the notion of nuclear hexagrams altogether, make the following additional changes:

Delete 870-910
Delete 1110-1150
Delete 1230
Delete 1320-1330

The most obvious limitation of the program is that is does not provide interpretation beyond hexagram name and number. The program can, of course, be modified to provide interpretation, though this strikes me as unwise. In the Wilhelm *I Ching*, each hexagram is given roughly 2700 words of interpretation, nearly 173,000 words for all 64 hexagrams. Even if one compressed this material—a step I would hesitate to undertake—one would still face a massive typing job. It makes more sense to refer to a book than to enter even a summary of the text.

Listing 2.

```
56    DIM R$ (64,2): FOR V = 1 TO 64 : FOR H = 1 TO 2 : READ
      R$ (V,H) : NEXT H,V
790   VTAB 22 : PRINT " # " ; H1 ; "    "; R$ (H1,1)
1290  HTAB 6 : PRINT H1 ; "   " ; R$ (H1,1) : PRINT
1310  HTAB 6 : PRINT H2 ; "   " ; R$ (H2,1) : PRINT
1330  HTAB 6 : PRINT N1 ; "   " ; R$ (N1,1) : PRINT
1350  HTAB 6 : PRINT N2 ; "   " ; R$ (N2,1) : PRINT
1351  PRINT : PRINT "TIMING (IF RELEVANT) :   "; R$ (H1,2)
```

However, for those who want the program to go further, the additions in Listing 1 will allow up to 510 characters of interpretation for each hexagram.

In addition, between lines 4700 and 6000, 128 DATA statements must be entered, summarizing the text for each hexagram in order, allowing two statements per hexagram, as the user sees fit.

It is, of course, possible to take the interpretation further, to provide a reading of individual lines; I leave consideration of such changes to whoever is motivated to do them.

An easier modification enables the program to give a sense of time, for questions having to the form "When will such-and-such happen?" The I Ching is often not satisfying in dealing with time questions, but the hexagrams do have seasonal associations, and a table of timing is found on page 225 of the Blofeld translation. It can be easily entered into the program with the following changes shown in Listing 2.

These changes simply increase the number of rows in the response table. Now, referring to the Blofeld table, the response data from 4020 to 4650 must be modified by adding the appropriate month to each hexagram, thus:

```
4020 DATA THE CREATIVE, MAY
```

down to:

```
4650 DATA BEFORE COMPLETION,
NOVEMBER
```

Finally, one can tighten the code. I have not bothered to do so. When, during debugging, I got the hexagram #63 AFTER COMPLETION, I cheerfully quit.

In summary, I have found the I Ching a powerful tool for understanding any question it is posed. I hope this program will stimulate other users to explore the deeper connections between ancient thought, apparently "chance" events, and microchip technology.

Acknowledgements: As a frequent journal reader, I'm sure that bits of previously published techniques have crept into this program; I am grateful to those contributors who have helped me. I would also like to thank Brugh Joy, M.D. for first introducing me to the I Ching.

References

1. *The I Ching or Book of Changes.* The Richard Wilhelm Translation rendered into English by Cary F. Baynes, Bollingen Series XIX, 1977, Princeton University Press.

2. *I Ching (The Book of Change).* Translated and Edited by John Blofeld, 1968, E.P. Dutton.

3. *I Ching or Book of Changes.* Translated by James Legge, 1969, Bantam Books. ☐

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Program Variables

CH	random number seed
DL	delay loop variable
H1	primary hexagram number
H2	secondary hexagram number
L	line numbers
L1$ - L6$	line number strings for concatenation
LN, LN$	lower nuclear trigram
LT, LT$	lower hexagram trigram
N1	first nuclear hexagram number
N2	second nuclear hexagram number
PS	VTAB line number position
PX	Printout flag
R$ ()	response table
T ()	lookup table
T1$	primary hexagram transformation string
T2$	secondary hexagram transformation string
TM	temporary value for return to program
UN, UN$	upper nuclear trigram
UT, UT$	upper hexagram trigram

```
10  REM   I CHING
12  REM
13  REM  -----------------------
14  REM   THIS PROGRAM THROWS &
16  REM   LOOKS UP HEXAGRAMS
18  REM   AND ALSO GENERATES
19  REM   SECONDARY AND NUCLEAR
20  REM   HEXAGRAMS
22  REM  -----------------------
23  REM
24  REM   COMPLETED 9/23/82
26  REM   BY MICHAEL CRICHTON
28  REM
30  REM   HEXAGRAM TITLES FROM
32  REM   THE I CHING OR BOOK OF CHANGES
34  REM   THE RICHARD WILHELM TRANSLATION
36  REM   RENDERED INTO ENGLISH BY CARY F. BAYNES,
38  REM   BOLLINGEN SERIES XIX.  COPYRIGHT
40  REM   RENEWED 1977 BY PRINCETON UNIV. PRESS
42  REM   HEXAGRAM TITLES, PP V-VII,
44  REM   REPRINTED BY PERMISSION OF
46  REM   PRINCETON UNIVERSITY PRESS
48  REM
50  REM   **** INITIALIZATION ***
51  REM
52  REM  T= LOOKUP TABLE, R$=RESPONSES
55  DIM T(8,8): FOR V = 1 TO 8: FOR H = 1 TO 8: READ T(V,H): NEXT H,V
56  DIM R$(64): FOR V = 1 TO 64: READ R$(V): NEXT V
99  REM
100  REM   **** FIRST OPTIONS ***
110  REM
120  HOME : TEXT
130  VTAB 8: HTAB 10: INVERSE : PRINT "  I CHING PROGRAM  ": NORMAL : VTAB 11: H
TAB 18: PRINT "BY": VTAB 14: HTAB 11: PRINT "MICHAEL CRICHTON"
140  VTAB 22: PRINT "(I)INSTRUCTIONS, (C)OINS, OR (M)ACHINE  INPUT?  ";: GET A$
150  IF A$ = "I" GOTO 6000: REM  INSTR
160  IF A$ = "C" GOTO 200: REM  COINS
170  IF A$ = "M" GOTO 300: REM  MACHINE INPUT
180  REM
200  REM   **** COIN INPUT ****
201  REM
210  HOME :PS = 18
220  VTAB 8: PRINT "TOSS COINS SIX TIMES..."
230  FOR I = 1 TO 6
240  VTAB (PS): INPUT L
250  IF L < 6 OR L > 9 THEN  VTAB (PS): PRINT "     VALUE UNACCEPTABLE": GOTO 240
260  POKE 780 + I,L
270 PS = PS - 1: NEXT I
280  GOTO 600
290  REM
300  REM   **** MACHINE INPUT ****
301  REM
310  HOME :PS = 18
320  VTAB 8: PRINT "PRESS  KEYBOARD SIX TIMES..."
330  FOR I = 1 TO 6
340 CH =  INT ( RND (1) * 100)
350 X =  INT ( RND (1) * CH)
360  IF X / 2 =  INT (X / 2) THEN X = 2: GOTO 380
370 X = 3
380  POKE 768,X
390 X =  INT ( RND (1) * CH)
400  IF X / 2 =  INT (X / 2) THEN X = 2: GOTO 420
410 X = 3
420  POKE 769,X
430 X =  INT ( RND (1) * CH)
440  IF X / 2 =  INT (X / 2) THEN X = 2: GOTO 460
450 X = 3
460  POKE 770,X
```

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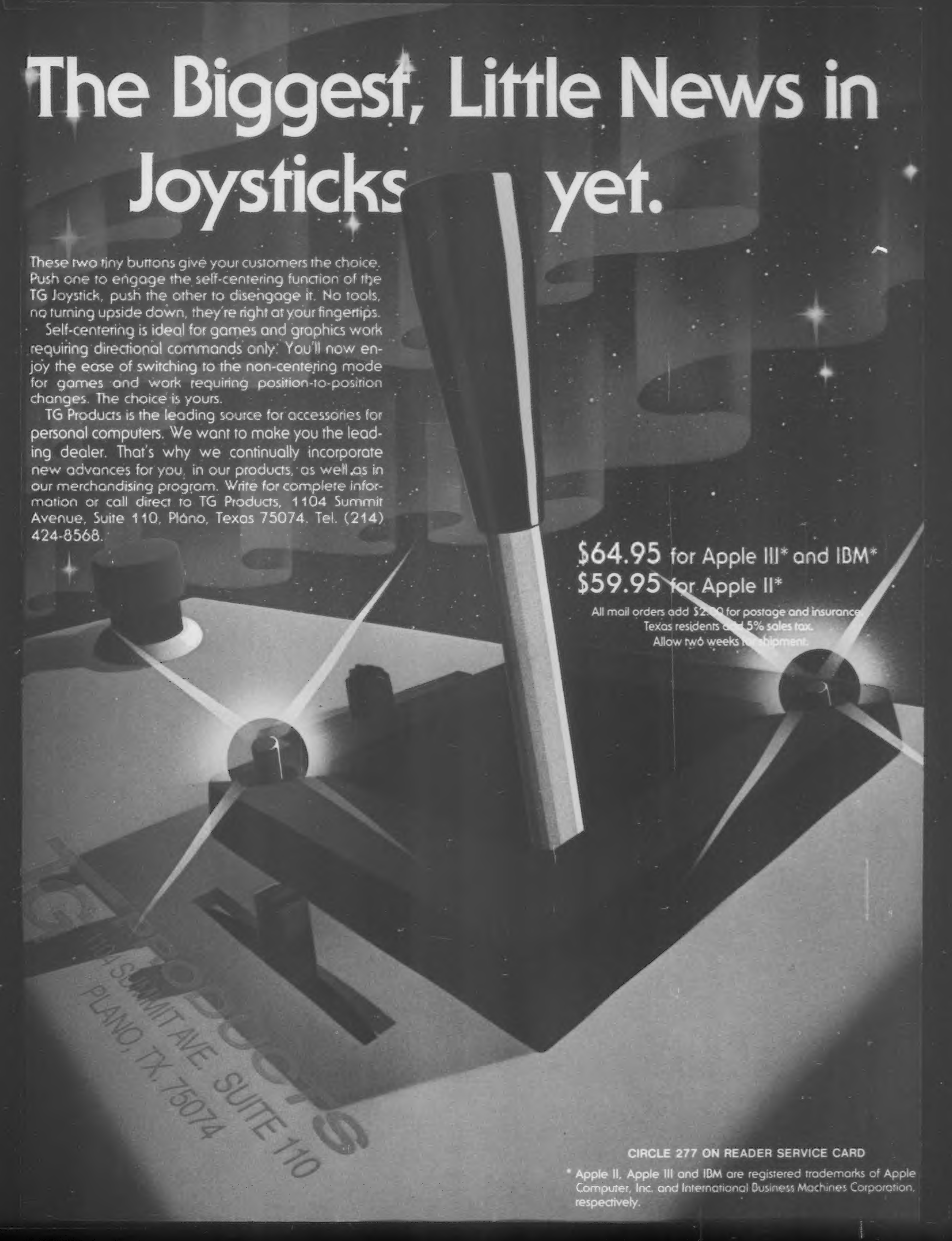

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```
470  REM
480  REM  KEYBOARD PRESSED?
485  REM
490 KB =  PEEK ( - 16384): IF KB > 127 THEN  POKE  - 16368,0: GOTO 520
500  GOTO 350: REM  BEGIN ANOTHER PASS
510  REM
520  REM  KEYBOARD WAS PRESSED
525  REM
530 L =  PEEK (768) +  PEEK (769) +  PEEK (770): VTAB (PS): PRINT L
540  POKE 780 + I,L
550 PS = PS - 1: NEXT I
555  PRINT  CHR$ (7): REM WARNING BEEP
560  REM
600  REM   **** BEGIN PROCESSING ***
610  REM
620  VTAB 12: PRINT "HEXAGRAM COMPLETED": FOR DL = 1 TO 500: NEXT
630  GR
640  COLOR= 15: FOR Y = 1 TO 39: HLIN 1,39 AT Y: NEXT
650  COLOR= 0:Y = 33:X1 = 10:X2 = 17:X3 = 23:X4 = 30
660  FOR I = 1 TO 6
670 Y = Y - 4:L =  PEEK (780 + I): GOSUB 2000
680  NEXT I
690  VTAB 24: GET A$
699  REM
700  REM    *** READ ANSWER ***
705  REM
710 L1$ =  STR$ ( PEEK (781)):L2$ =  STR$ ( PEEK (782)):L3$ =  STR$ ( PEEK (783)
):L4$ =  STR$ ( PEEK (784)):L5$ =  STR$ ( PEEK (785)):L6$ =  STR$ ( PEEK (786))
730 LT$ = L1$ + L2$ + L3$:UT$ = L4$ + L5$ + L6$: REM LOWER/UPPER TRIGRAMS
740 T1$ = LT$: GOSUB 2200: GOSUB 3000
750 LT = TM
760 T1$ = UT$: GOSUB 2200: GOSUB 3000
770 UT = TM
780 H1 = T(LT,UT): REM PRIMARY HEXAGRAM VAL
790  VTAB 22: PRINT " # ";H1;"    ";R$(H1)
800  FOR DL = 1 TO 500: NEXT DL
810  VTAB 24: PRINT " LINES ARE:    ";L1$;"-";L2$;"-";L3$;"-";L4$;"-";L5$;"-";L6$
;"  ";: GET A$
820  REM   *** OTHER TRIGRAMS ***
830  REM  SECONDARY TRIGRAM
840 T2$ = LT$: GOSUB 2300: GOSUB 3000:LT = TM
850 T2$ = UT$: GOSUB 2300: GOSUB 3000:UT = TM
860 H2 = T(LT,UT): REM H2=2NDARY HEXAGRAM VAL
870  REM   FIRST NUCLEAR
880 LN$ = L2$ + L3$ + L4$:UN$ = L3$ + L4$ + L5$
890 T1$ = LN$: GOSUB 2200: GOSUB 3000:LN = TM
900 T1$ = UN$: GOSUB 2200: GOSUB 3000:UN = TM
910 N1 = T(LN,UN): REM  NUCLEAR 1 HEX VAL
920  REM   SECOND NUCLEAR
930 T2$ = LN$: GOSUB 2300: GOSUB 3000:LN = TM
940 T2$ = UN$: GOSUB 2300: GOSUB 3000:UN = TM
950 N2 = T(LN,UN): REM  NUCLEAR 2 HEX VAL
960  REM
970  REM    *** MORE HEXS ***
980  REM
990  GR : HOME
1000  COLOR= 15: FOR Y = 0 TO 19: HLIN 0,19 AT Y: NEXT : REM  BACKGROUND
1010  REM  DRAW ORIGINAL HEXAGRAM
1020  COLOR= 0
1030 Y = 17:X1 = 3:X2 = 7:X3 = 12:X4 = 16
1040  FOR I = 1 TO 6:L =  PEEK (780 + I): GOSUB 2000:Y = Y - 3: NEXT I
1050  REM
1060  REM  DRAW SECONDARY HEXAGRAM
1070  COLOR= 15
1080 Y = 17:X1 = 22:X2 = 27:X3 = 31:X4 = 36
1090  FOR I = 1 TO 6:L =  PEEK (780 + I): GOSUB 2100: GOSUB 2000:Y = Y - 3: NEXT I
1100  REM
1110  REM  DRAW NUCLEAR #1
1120  COLOR= 1
1130 Y = 37:X1 = 3:X2 = 7:X3 = 12:X4 = 16
1140  FOR I = 1 TO 3:L =  PEEK (781 + I): GOSUB 2000:Y = Y - 3: NEXT I
1150  FOR I = 1 TO 3:L =  PEEK (782 + I): GOSUB 2000:Y = Y - 3: NEXT I
1160  REM
1170  REM  DRAW NUCLEAR #2
1175  REM
1180 Y = 37:X1 = 22:X2 = 27:X3 = 31:X4 = 36
```

```
1190  FOR I = 1 TO 3:L =  PEEK (781 + I): GOSUB 2100: GOSUB 2000:Y = Y - 3: NEXT I
1200  FOR I = 1 TO 3:L =  PEEK (782 + I): GOSUB 2100: GOSUB 2000:Y = Y - 3: NEXT I
1210  REM
1220  VTAB 22: HTAB 10: PRINT H1;: HTAB 30: PRINT H2: PRINT
1230  HTAB 10: PRINT N1;: HTAB 30: PRINT N2
1240  GET A$
1244  REM
1245  REM   *** SUMMARY PAGE ***
1246  REM
1250  TEXT : HOME
1260  PRINT "ORIGINAL LINES WERE:   ";L1$;"-";L2$;"-";L3$;"-";L4$;"-";L5$;"-";L6 $
1270  PRINT "----------------------------------------": PRINT
1280  PRINT "PRIMARY HEXAGRAM-": PRINT
1290  HTAB 6: PRINT H1;"  ";R$(H1): PRINT
1300  PRINT "SECONDARY HEXAGRAM-": PRINT
1310  HTAB 6: PRINT H2;"  ";R$(H2): PRINT
1320  PRINT "FIRST NUCLEAR-": PRINT
1330  HTAB 6: PRINT N1;"  ";R$(N1): PRINT
1340  PRINT "SECOND NUCLEAR-": PRINT
1350  HTAB 6: PRINT N2;"  ";R$(N2)
1352 :
1355  IF PX = 1 THEN  PRINT : PRINT  CHR$ (4);"PR#0": GOTO 1370
1360  PRINT : PRINT : PRINT "DO YOU WANT A PRINTOUT (Y/N)?";: GET A$
1362  FOR B = 1 TO 29: PRINT  CHR$ (8);: PRINT " ";: PRINT  CHR$ (8);: NEXT B
1363  IF A$ = "N" GOTO 1370
1364 PX = 1: INPUT "TODAY'S DATE (MM/DD/YY)?";D$
1365  FOR B = 1 TO 40: PRINT  CHR$ (8);: PRINT " ";: PRINT  CHR$ (8);: NEXT B
1367  PRINT "WHAT WAS YOUR QUESTION?": INPUT Q$: PRINT  CHR$ (4);"PR#1": PRINT :
 PRINT D$;"   ";Q$: PRINT
1368  GOTO 1260
1369 :
1370  END
1380 :
1998  REM  **** START SUBROUTINES ***
1999  REM
2000  REM *** DRAW GRAPHIC ****
2005  REM
2010  IF L = 6 THEN  HLIN X1,X2 AT Y: HLIN X3,X4 AT Y: RETURN
2020  IF L = 7 THEN  HLIN X1,X4 AT Y: RETURN
2030  IF L = 8 THEN  HLIN X1,X2 AT Y: HLIN X3,X4 AT Y: RETURN
2040  IF L = 9 THEN  HLIN X1,X4 AT Y: RETURN
2050  REM
2100  REM *** 2NDARY HEX CONVERSION
2105  REM
2110  IF L = 6 THEN L = 7: RETURN
2120  IF L = 9 THEN L = 8: RETURN
2130  REM
2200  REM *** CONVERT TRIGRAM #'S  FOR LOOKUP ***
2205  REM
2210 S$ = "":X$ = "": REM  NULL
2220  FOR N = 1 TO  LEN (T1$)
2230 X$ =  MID$ (T1$,N,1)
2240  IF X$ = "6" THEN X$ = "8"
2250  IF X$ = "9" THEN X$ = "7"
2260 S$ = S$ + X$: NEXT N
2270 T1$ = S$: RETURN
2280  REM
2300  REM  *** CONVERT OTHER TRIGRAMS ***
2305  REM
2310 S$ = "":X$ = "": REM  NULL
2320  FOR N = 1 TO  LEN (T2$)
2330 X$ =  MID$ (T2$,N,1)
2340  IF X$ = "6" THEN X$ = "7"
2350  IF X$ = "9" THEN X$ = "8"
2360 S$ = S$ + X$: NEXT N
2370 T1$ = S$: RETURN
2380  REM
3000  REM *** CONVERT 1-8 ****
3005  REM
3010 TM =  VAL (T1$)
3020  IF TM = 777 THEN TM = 1: GOTO 3100
3030  IF TM = 788 THEN TM = 2: GOTO 3100
3040  IF TM = 878 THEN TM = 3: GOTO 3100
3050  IF TM = 887 THEN TM = 4: GOTO 3100
```

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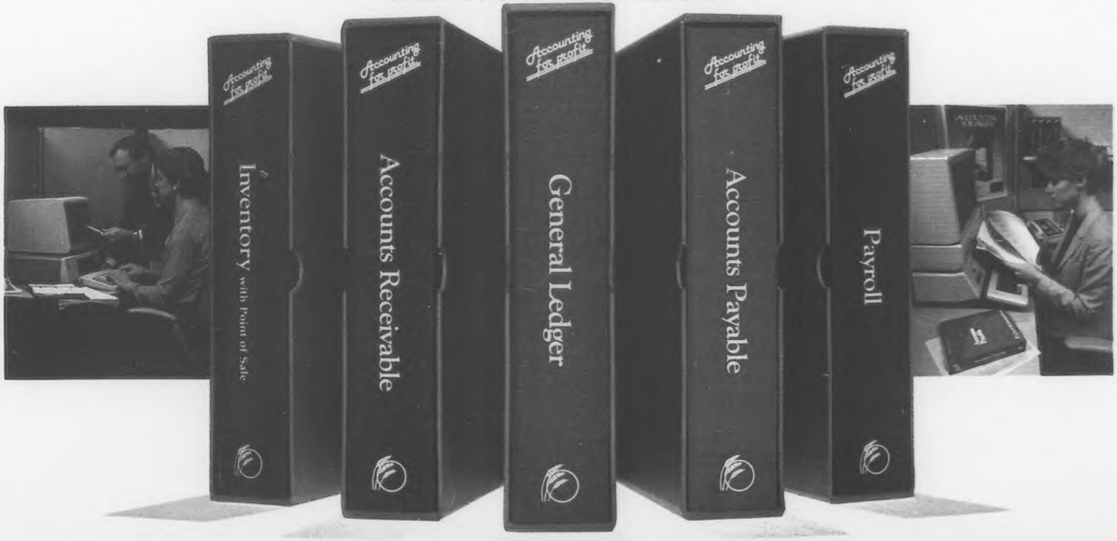

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```
3060   IF TM = 888 THEN TM = 5: GOTO 3100
3070   IF TM = 877 THEN TM = 6: GOTO 3100
3080   IF TM = 787 THEN TM = 7: GOTO 3100
3090   IF TM = 778 THEN TM = 8
3100   RETURN
3110   REM
3500   REM  *** LOOKUP TABLE DATA ***
3510   REM
3520   DATA  1,34,5,26,11,9,14,43
3530   DATA  25,51,3,27,24,42,21,17
3540   DATA  6,40,29,4,7,59,64,47
3550   DATA  33,62,39,52,15,53,56,31
3560   DATA  12,16,8,23,2,20,35,45
3570   DATA  44,32,48,18,46,57,50,28
3580   DATA  13,55,63,22,36,37,30,49
3590   DATA  10,54,60,41,19,61,38,58
3595   REM
4000   REM  *** RESPONSE DATA ***
4010   REM
4020   DATA  THE CREATIVE
4030   DATA  THE RECEPTIVE
4040   DATA  DIFFICULTY AT THE BEGINNING
4050   DATA  YOUTHFUL FOLLY
4060   DATA  WAITING (NOURISHMENT)
4070   DATA  CONFLICT
4080   DATA  THE ARMY
4090   DATA  HOLDING TOGETHER (UNION)
4100   DATA  THE TAMING POWER OF THE SMALL
4110   DATA  TREADING (CONDUCT)
4120   DATA  PEACE
4130   DATA  STANDSTILL (STAGNATION)
4140   DATA  FELLOWSHIP WITH MEN
4150   DATA  POSSESSION IN GREAT MEASURE
4160   DATA  MODESTY
4170   DATA  ENTHUSIASM
4180   DATA  FOLLOWING
4190   DATA  WORK ON WHAT HAS BEEN SPOILED (DECAY)
4200   DATA  APPROACH
4210   DATA  CONTEMPLATION (VIEW)
4220   DATA  BITING THROUGH
4230   DATA  GRACE
4240   DATA  SPLITTING APART
4250   DATA  RETURN (THE TURNING POINT)
4260   DATA  INNOCENCE (THE UNEXPECTED)
4270   DATA  THE TAMING POWER OF THE GREAT
4280   DATA  THE CORNERS OF THE MOUTH (PROVIDING NOURISHMENT)
4290   DATA  PREPONDERANCE OF THE GREAT
4300   DATA  THE ABYSMAL (WATER)
4310   DATA  THE CLINGING/ FIRE
4320   DATA  INFLUENCE (WOOING)
4330   DATA  DURATION
4340   DATA  RETREAT
4350   DATA  THE POWER OF THE GREAT
4360   DATA  PROGRESS
4370   DATA  DARKENING OF THE LIGHT
4380   DATA  THE FAMILY (THE CLAN)
4390   DATA  OPPOSITION
4400   DATA  OBSTRUCTION
4410   DATA  DELIVERANCE
4420   DATA  DECREASE
4430   DATA  INCREASE
4440   DATA  BREAK-THROUGH (RESOLUTENESS)
4450   DATA  COMING TO MEET
4460   DATA  GATHERING TOGETHER (MASSING)
4470   DATA  PUSHING UPWARD
4480   DATA  OPPRESSION (EXHAUSTION)
4490   DATA  THE WELL
4500   DATA  REVOLUTION (MOULTING)
4510   DATA  THE CALDRON
4520   DATA  THE AROUSING (SHOCK/THUNDER)
4530   DATA  KEEPING STILL/ MOUNTAIN
4540   DATA  DEVELOPMENT (GRADUAL PROGRESS)
4550   DATA  THE MARRYING MAIDEN
4560   DATA  ABUNDANCE (FULLNESS)
4570   DATA  THE WANDERER
```

```
4580  DATA  THE GENTLE (THE PENETRATING/ WIND)
4590  DATA  THE JOYOUS/LAKE
4600  DATA  DISPERSION (DISSOLUTION)
4610  DATA  LIMITATION
4620  DATA  INNER TRUTH
4630  DATA  PREPONDERANCE OF THE SMALL
4640  DATA  AFTER COMPLETION
4650  DATA  BEFORE COMPLETION
4660 :
4670 :
6000  REM  ***INSTRUCTIONS***
6010  HOME
6020  PRINT "THE I CHING IS AN ANCIENT CHINESE       METHOD OF DIVINATION.  BY R
EPEATEDLY    THROWING STICKS OR COINS, A SIX-LINE    FIGURE, OR HEXAGRAM, IS CREATED."
6030  PRINT
6040  PRINT "THIS HEXAGRAM IS INTERPRETED  BY        CONSULTING A METAPHORICAL TEXT."
6050  PRINT
6060  PRINT "FURTHER INFORMATION CAN BE OBTAINED  BY DERIVING A SECONDARY HEXAGR
AM, AND TWO  SO-CALLED 'NUCLEAR HEXAGRAMS'. "
6070  PRINT
6080  PRINT "THIS PROGRAM PROVIDES THE HEXAGRAM NAMESONLY.  FOR FURTHER INTERPRE
TATION, USERSSHOULD OBTAIN A  GOOD I CHING TEXT, SUCHAS THE CLASSIC TRANSLATION
BY RICHARD   WILHELM (PRINCETON UNIVERSITY PRESS)."
6090  GOSUB 8000
6100  HOME : PRINT "CASTING THE I CHING"
6110  PRINT : INVERSE : PRINT "WITH COINS": NORMAL
6120  PRINT
6130  PRINT "USE THREE SIMILAR   COINS, SUCH AS       PENNIES. ASSIGN ONE FACE TH
E VALUE OF 3,AND THE OTHER FACE THE VALUE OF 2. THINKON YOUR QUESTION AS YOU CAS
T THE COINS  SIX TIMES."
6140  PRINT
6150  PRINT "AFTER EACH THROW, SUM THE THREE FACES,  TO GET A VALUE FROM 6 TO 9.
ENTER THIS   VALUE INTO THE COMPUTER."
6160  PRINT : PRINT : INVERSE : PRINT " BY COMPUTER ": NORMAL : PRINT
6170  PRINT
6180  PRINT "THE COMPUTER WILL SIMULATE COIN TOSSES  IF YOU PRESS ANY KEY SIX TIMES."
6190  GOSUB 8000
6200  HOME : PRINT "INTERPRETING THE I CHING": PRINT : PRINT
6210  PRINT "THE COMPUTER FIRST GENERATES THE PRIMARYHEXAGRAM.  SOME USERS PREFE
R TO MEDITATEON THIS FIGURE DIRECTLY, WITHOUT         ADDITIONAL DATA."
6220  PRINT : PRINT
6230  PRINT "1.(RETURN) WILL ADD THE HEXAGRAM NAME,  AND THE LINE VALUES READING
 FROM BOTTOM TO TOP.": PRINT
6240  PRINT
6260  PRINT "2.(RETURN) WILL GENERATE THE SECONDARY  AND NUCLEAR HEXAGRAMS, AND
THEIR         NUMBERS...."
6270  VTAB 20: PRINT "PRESS ANY KEY TO SEE THIS PATTERN";: GET A$: GOSUB 7010
6280  GOSUB 8000: HOME : VTAB 5
6290  PRINT "A FINAL (RETURN) WILL SUMMARIZE THE     DATA ON ALL FOUR HEXAGRAMS,
 AND          PROVIDE A PRINTOUT OPTION."
6300  GOTO 140
6310  REM
7000  REM  ***GRAPHIC INSTR***
7010  HOME
7020  FOR X = 1 TO 20: VTAB (X): HTAB 19: PRINT "1": NEXT
7030  FOR X = 1 TO 39: VTAB 10: HTAB (X): PRINT "-": NEXT
7040  VTAB 5: HTAB 5: PRINT "ORIGINAL": HTAB 5: PRINT "HEXAGRAM"
7050  FOR X = 1 TO 500: NEXT : SPEED= 100
7060  FOR X = 14 TO 23: VTAB 6: HTAB (X): PRINT ">";: NEXT : SPEED= 255
7070  SPEED= 255
7080  VTAB 5: HTAB 25: PRINT "SECONDARY": HTAB 25: PRINT "HEXAGRAM"
7090  FOR X = 1 TO 500: NEXT : SPEED= 100
7100  FOR X = 7 TO 14: VTAB (X): HTAB 8: PRINT "!": NEXT : SPEED= 255
7110  VTAB 15: HTAB 5: PRINT "NUCLEAR": HTAB 5: PRINT "HEXAGRAM": HTAB 5: PRINT
"DERIVED": HTAB 5: PRINT "FROM ORIGINAL"
7120  FOR X = 1 TO 500: NEXT : SPEED= 100
7130  FOR X = 7 TO 14: VTAB (X): HTAB 28: PRINT "!": NEXT : SPEED= 255
7140  VTAB 15: HTAB 25: PRINT "NUCLEAR": HTAB 25: PRINT "HEXAGRAM": HTAB 25: PRI
NT "DERIVED": HTAB 25: PRINT "FROM SECONDARY"
7150  SPEED= 255
7160  RETURN
7997  REM
7998  REM  ***PAUSE***
7999  REM
8000  VTAB 24: PRINT "PRESS ANY KEY TO CONTINUE";: GET A$: RETURN
```

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Part Two

TRS-80 Graphics Made Almost Painless

John Crew

This is the second article in a three part series. The first segment appeared in the January 1982 issue. Here we discuss some quirks of Level II Basic and describe Vector Plotter, a program that draws lines on the screen between any two points. Vector Plotter can produce random vectors, or you can supply the x, y coordinates of the initial and terminal points of a vector.

Many people don't know what *vector* means because it is often misused. The correct definition—used by mathematicians, engineers, and scientists other than biologists—is a line which has two properties, length and direction. Some programmers use vector to mean *array*. Airplane pilots and science fiction writers often use it in place of *direction*. Biologists use vector to mean "a disease carrying organism."

Peculiarities of Level II

There are two problems with the VAL function, which are not mentioned in the reference manual. The first problem is that VAL doesn't recognize numeric character strings preceded by a minus sign if there are blanks before the minus sign. That problem was described in Radio Shack's "Microcomputer News" (Oct. and Nov. 1980 issues). The second problem is that if a percent symbol is the first nonblank character after a string of numeric characters, an SN (syntax) error message will be printed when VAL is used on that string.

Apparently the programmers at Microsoft were uncertain about what should be done in this case. They could divide the value by 100 to get a decimal equivalent, they could leave the number as a percentage, or they could have an error result and leave it to you to write an error handling subroutine to perform whichever calculation you want.

They chose the latter option, but for some reason they call it an SN error instead of an FC (illegal function argument) error. Listing 1 demonstrates both problems with the VAL function. Listing 2 shows the extra lines needed to make the program in Listing 1 work as desired.

If you want the decimal equivalent of a percentage instead of the percentage returned by VAL, then use an error handling subroutine like the one in Listing 2 but insert /100 after

```
LV=VAL (LEFT$(B,K-1))
```

in line 100.

Because I often want compact programs, I sometimes use IF-THEN statements with an implied THEN. The Level II reference manual doesn't say when THEN is unnecessary, so by experiment I discovered when it can be omitted.

Figure 1 shows different legal IF-THEN-ELSE statements, most of which use an implied THEN, that don't work properly.

The first two examples in Figure 2 have the same error. In a compact IF-THEN-ELSE statement with an implied THEN, if the logical expression ends with a string constant, the THEN branch works properly, but the ELSE branch will be ignored. That problem can be solved by reversing the last comparison (so it is "YES"=IN$) or by inserting a comma, blank space, or THEN between the logical expression and the THEN branch.

Another solution would be to put parentheses around the logical expression. That problem is one of the few cases I know of which can be solved by inserting a space; Level II usually ignores spaces.

An odd IF-THEN-ELSE statement I found doesn't have a THEN branch. It is

```
IFA=BELSEPRINT"NOT EQUAL"
```

If the logical expression is true, nothing is done, otherwise the ELSE branch is taken.

I suggest you avoid using unusual forms of IF-THEN or IF-THEN-ELSE state-

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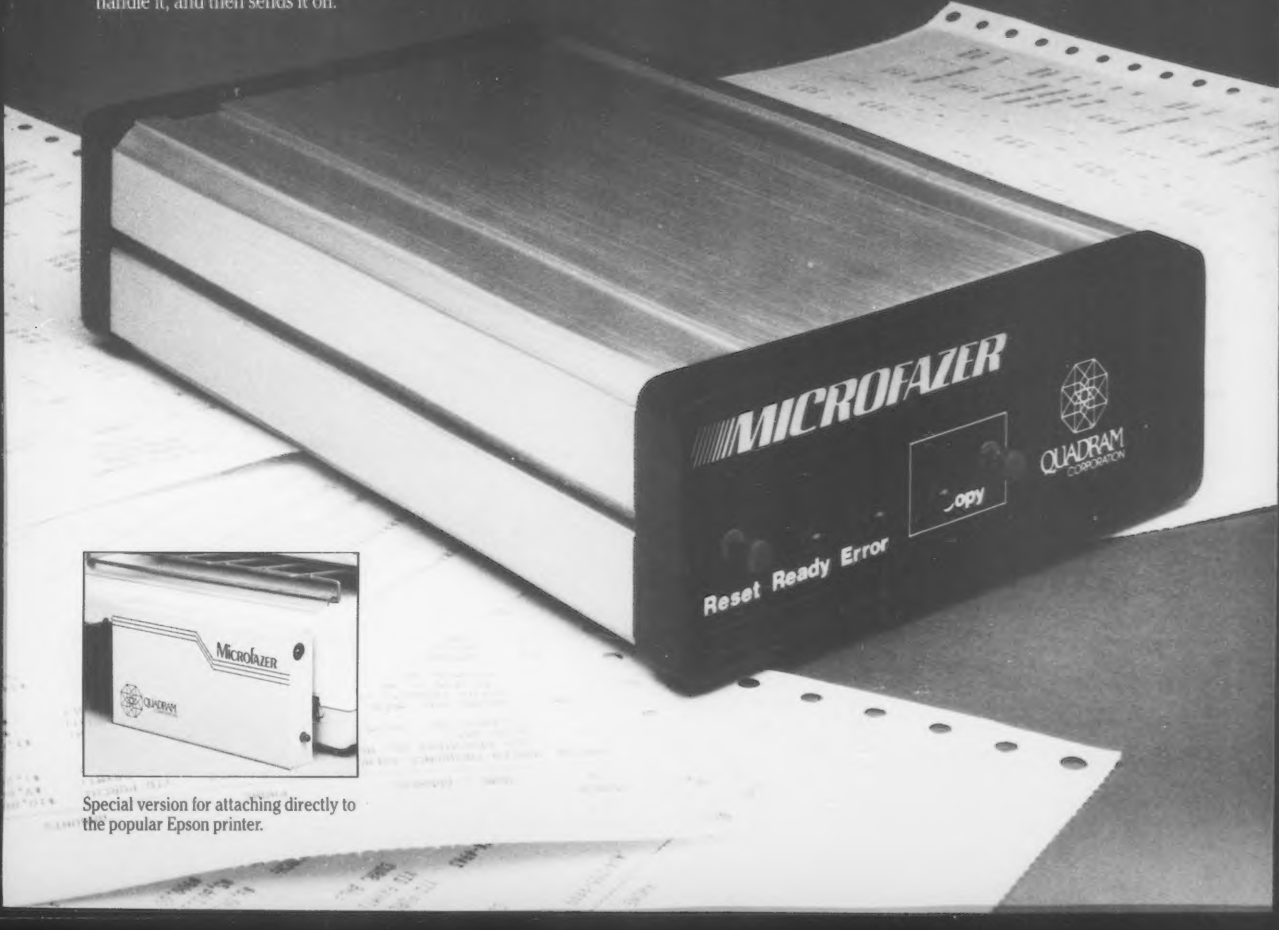

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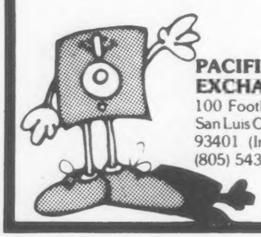

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TRS-80 Graphics, continued...

Figure 1.

Examples of Legal IF-THEN-ELSE statements

Example	Indicator of Separation of Logical Expression and THEN Branch	Notes
`IFA=BTHENC=0ELSEC=1`	THEN	
`IFA=B,C=0ELSEC=1`	Comma	A comma works like THEN. This is allowed because some other versions of Basic allow it.
`IFA%=B%C%=0ELSEC%=1`	Type declaration character ($,%,!,#)	
`IFA=1/(B+1)C=0ELSEC=1`	Parenthesis	
`IFA=BPRINT''SAME''ELSE PRINT''DIFFERENT''`	Basic keyword	
`IFA=B:C=0ELSEC=1`	Colon	The colon takes the place of THEN here, but as Figure 2 shows, this doesn't work if you want the THEN branch to be an implied GOTO branch.
`IFA=1B=-1ELSEB=10`	Transition from numeric character string to a variable name which doesn't start with E or D.	
`IFA=0,1000ELSE2000`	Comma	`IFA=0GOTO1000ELSEGOTO2000` is equivalent.
`IF10=A%90ELSE100`	Type declaration character	Equivalent to `IF10=A%GOTO90ELSE100`
`IFA=8/(B+1)100ELSE90`	Right parenthesis	Equivalent to `IFA=8/(B+1)GOTO100ELSE90`

Figure 2.

Examples of IF-THEN-ELSE Statements Which Don't Work as Desired

Example	Separation Indicator	Notes
`IFIN$=''YES''AFFIRM=AFFIRM+1 ELSENEG=NEG+1`	Quotation mark	*
`IFIN$=''YES''PRINT''AGREE''ELSE PRINT''DISAGREE''`	Quotation mark	*
`IFA!=3E=1:PRINT''TRUE''ELSE PRINT''FALSE''`	None	**
`IFA#=8D=-1:PRINT''TRUE''ELSE PRINT''FALSE''`	None	**

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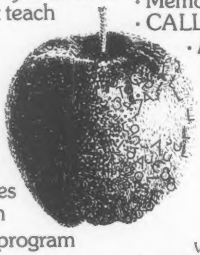

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`IFA=BC=-1ELSESTOP`	None	***
`IFA=B C=-1ELSESTOP`	None	***
`IF0=TANDS=0STOPELSE100`	None	There is a syntax error in the logical expression. The TAN is interpreted as a function name which isn't what I want.
`IF0=T AND S=0) THEN80ELSE90`	THEN	The logical expression is interpreted the same as: `(0=TAN(DS))=0` which is equivalent to `NOT(0=TAN(DS))` or `0<>TAN(DS)`.
`IFI=9:10ELSE20`	Colon	If true, a SN error results. If false, nothing happens.

* If true, the THEN branch is used; but if false, the ELSE branch is never taken. See article for a list of solutions to this problem.

** The ELSE branch is used if false. Because E or D if used before an exponent the assignment statement is considered part of the preceeding logical expression.

*** This is interpreted the same as ((A=BC)=-1) which has a logical expression within a logical expression. It is equivalent to A=BC.

Figure 3.

Variables Used in Vector Plotter

Type	Name(s)	Use(s)
Integer	X1	X coordinate of initial point.
	Y1	Y coordinate of initial point.
	X2	X coordinate of terminal point.
	Y2	Y coordinate of terminal point.
	N	The number of x,y coordinates stored so far.
	L	The number of x,y coordinates which will be stored.
	I	Count of characters entered in coordinate entry subroutine.
	MV	The maximum number of vectors which can be stored.
	X	Loop counter for drawing lines; it is the current x coordinate of the cursor. Temporary storage.
	Y	Loop counter for drawing lines; it is the current y coordinate of the cursor. Temporary storage.
Single Precision	A	Used in line drawing calculations. It is either the slope or the reciprocal of the slope. Temporary storage.
	B	Used in line drawing calculations, for x or y coordinate. Temporary storage.
	C(0→(MV-1))	Coordinate storage array.
Character String	QA	Last character entered.
	B	String of characters entered in coordinate entry subroutine.

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ments because line renumbering programs, Basic compilers, and other versions of Basic almost certainly won't allow such things. Besides those problems, using odd formats of Basic statements makes your programs hard to read or debug. Only use unusual forms of Basic statements if you desperately need to save memory or you want your program to be incomprehensible.

Multiple IF-THEN-ELSE statements

I often use complex, multiple IF-THEN-ELSE statements to consolidate a long process into one program line. This eliminates many GOTO statements so the program is easier to read and runs faster. The Level II manual isn't very helpful in explaining how to write complex, multiple IF-THEN-ELSE statements and it even gives an incorrect example on page 4/17. Contrary to the claim in the manual, you can't nest IF-THEN-ELSE statements within an IF-THEN-ELSE statement. (The writers of the manual were thinking of Fortran or perhaps PL/1.) ELSE is matched with the most recent THEN (or implied THEN) in that program line. See the following listings for examples.

How To Use Vector Plotter

In the instructions you will see the maximum number of pairs of endpoints which can be stored (which is the same as the number of vectors which can be stored). The maximum number of vectors is calculated in line 100 based on the amount of free memory. The formula was arrived at by experimentation. Some free space is left for use by Basic. The more free memory you have, the smaller the percentage used for the coordinate array.

After the instructions, you are asked if you want random vectors. Usually, my programs look for Y and anything else is treated as no, but in line 150 of Vector Plotter you must reply Y or N.

If you don't want random vectors, you are next asked how many vectors you want to enter. You should ask for as many or more than you expect to enter. The computer then asks for the coordinates of the initial and terminal points. After you enter each pair of endpoint coordinates, the number of endpoint pairs entered so far is printed. You may leave this loop early by pressing the S key instead of entering coordinates. To see instructions, press the H key instead of entering coordinates. H and S are recognized only when they are pressed before you have typed anything in response to an input request.

Entering Coordinates

If you want a nonzero x coordinate, type it first. Then if you want a nonzero y coordinate, type a decimal point followed by the y coordinate. If the y coordinate is only one digit, put a zero between the decimal point and the digit. If you press ENTER without typing anything, the x and y values are set to zero by default. To backspace and erase the last character, press the key as usual.

The x coordinate must be between 0 and 127. The y coordinate must be between 0 (bottom of the screen) and 47 (top of the screen)—the y coordinate is inverted from the standard Level II use by subtracting the requested y coordinate from 47.

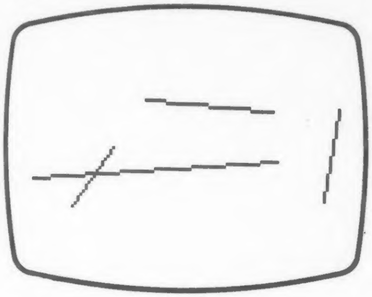
The computer constantly checks to see if the value you typed has an x or y coordinate which is too high or too low. If either the x or y coordinate is too high or too low, the last digit entered

First sample run of Vector Plotter.

```
DO YOU WANT RANDOM VECTORS? Y
HOW MANY RANDOM VECTORS? 4

PAIR # 1     PAIR # 3

PAIR # 2     PAIR # 4
```



Listing 1. Demonstration of the Two Problems with the VAL Function.

```
10 CLEAR 100:  DEFSTR A-B:  DEFINT I-Z
20 DATA12,-87,1 %,-100 %
30 CLS:  PRINT TAB(6)"EXAMPLE OF TWO PECULIARITIES OF THE VAL FUNCTION":  PRINT
TAB(19)"BY JOHN CREW  11/27/81":  PRINT
40 PRINT"STRING", "LENGTH", "VAL(STRING)"
50 FOR I=1 TO 4:  READ A
60   FOR J=0 TO 1:  B=STRING$(J,32)+A:  PRINT B, LEN(B),
70     V=VAL(B)
80     PRINT V
90   NEXT J
95 NEXT I
```

Listing 2. Extra Lines Needed to Make the Program in Listing 1 Work as Desired.

```
15 ON ERROR GOTO 100
64 REM LINES 65-66 REMOVE LEADING BLANKS FROM THE STRING NAMED "B". THIS WILL FI
X THE PROBLEM OF A NEGATIVE NUMERIC STRING BEING IGNORED IF THERE ARE BLANKS IN
FRONT OF IT.
65     IF LEN(B)=0 THEN 70 ELSE P=0:  FOR K=1 TO LEN(B):  IF MID$(B,K,1)<>" " TH
EN P=K-1:  K=256
66     NEXT K:  B=RIGHT$(B,LEN(B)-P)
96 END:  REM LINES 100-110 ARE AN ERROR HANDLING SUBROUTINE. ANY ERROR EXCEPT A
SN ERROR IN LINE 70 IS HANDLED IN THE USUAL WAY. LINE 110 AND THE "ELSE" BRANCH
IN LINE 100 ARE ONLY USED FOR A SN ERROR IN LINE 70.
97 REM IF A SN ERROR IN LINE 70 OCCURS, THE STRING NAMED B IS SEARCHED, FROM LEF
T TO RIGHT, FOR A "%" SYMBOL. THEN THE VAL FUNCTION IS USED ON THE PORTION OF TH
E STRING BEFORE THE "%" SYMBOL.
98 REM A REAL SN ERROR IN LINE 70 WON'T BE TREATED AS SUCH. MAKE SURE LINE 70 IS
 TYPED CORRECTLY BEFORE RUNNING THE PROGRAM.
100 IF ERR/2+1<>2 OR ERL<>70 THEN ON ERROR GOTO 0 ELSE FOR K=1 TO LEN(B):  IF MI
D$(B,K,1)="%" THEN V=VAL(LEFT$(B,K-1)):  K=256
110 NEXT K:  RESUME NEXT
```

Listing 3. Vector Plotter.

```
100 CLEAR12:DEFINTA-Z:RANDOM:MV=FIX((MEM-477)/9)*2!:DIMC!(MV-1):MV=FIX((MV+1)/2!
)
105 REM LINES 110 & 120 PRINT INSTRUCTIONS
110 QA$=" COORDINATES ":CLS:PRINTTAB(23)"VECTOR PLOTTER
"TAB(20)"BY JOHN CREW 11/27/81
THIS CAN WORK IN TWO WAYS:  THE COMPUTER CAN PLOT RANDOM LINES, OR YOU CAN ENTER
 THE X,Y"QA$"OF THE INITIAL AND TERMINALPOINTS.
MAXIMUM NUMBER OF LINES="STR$(MV)".
(0,0) ";
120 PRINT"IS THE LOWER LEFT-HAND POINT. (127,47) IS THE UPPER RIGHT-HAND POINT.
PRESS 'H' FOR HELP INSTEAD OF ENTERING THE"QA$"OF A
POINT.
PRESS 'S' TO STOP BEFORE ENTERING THE NUMBER OF LINES YOU
SPECIFY.
"TAB(13)"PRESS ANY KEY BUT 'BREAK' TO BEGIN":GOSUB446
140 REM LINES 150-220 EITHER GENERATE RANDOM VECTORS OR CALL THE X,Y COORDINATES
 ENTRY SUBROUTINE
150 N=0:CLS:PRINT"DO YOU WANT RANDOM VECTORS? ";
160 GOSUB420:IFQA$="Y"THENX=1:GOTO170ELSEIFQA$="N"THENX=2:GOTO180ELSEIF" "<=QA$P
RINTCHR$(8);
165 GOTO160
```

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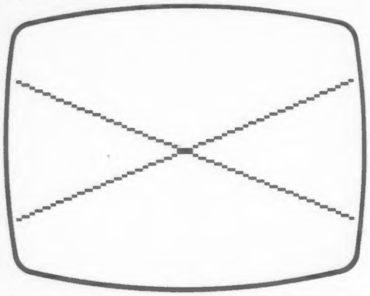
TRS-80 Graphics, continued...

Second sample run of Vector Plotter.

```
DO YOU WANT RANDOM VECTORS? N
HOW MANY VECTORS DO YOU WANT TO ENTER? 2

ENTER INITIAL POINT'S COORDINATES?
ENTER TERMINAL POINT'S COORDINATES? 127.47
PAIR # 1

ENTER INITIAL POINT'S COORDINATES? .47
ENTER TERMINAL POINT'S COORDINATES? 127
PAIR # 2
```

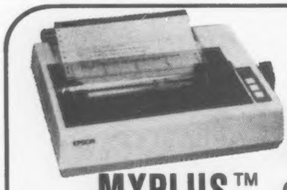


is rejected; you aren't allowed to type an illegal coordinate. If you press a key which isn't used for coordinate entry, it is ignored. I have tried to make this program foolproof.

After all the coordinates have been stored, the vectors are drawn. There is a delay of a few seconds before the first vector is drawn.

To quit using Vector Plotter, press the BREAK key. ☐

```
170 INPUT"
HOW MANY RANDOM VECTORS";L:IFL<1THEN150ELSEIFMV<LTHEN170ELSE200
180 CLS:INPUT"HOW MANY VECTORS DO YOU WANT TO ENTER";L:IFL<1ORMV<LTHEN180
200 IFX=2QA$="INITI":GOSUB370:B!=A!:QA$="TERMIN":GOSUB370ELSEB!=(RND(48)-1)/100+
RND(128)-1:A!=(RND(48)-1)/100+RND(128)-1
220 C!(N)=B!:C!(N+1)=A!:N=N+2:PRINT"
PAIR #"N/2:IFN/2<LTHEN200
230 CLS' CLEAR SCREEN BEFORE DRAWING VECTORS
233 REM LINES 235-350 DRAW VECTORS
235 FORI=0TON-1STEP2:X1=FIX(C!(I)):Y1=47-FIX(100*(C!(I)-X1+.002)):X2=FIX(C!(I+1)
):Y2=47-FIX(100*(C!(I+1)-X2+.002)):IFX1=X2IFY1=Y2:SET(X1,Y1):GOTO350ELSEFORY=Y1T
OY2STEPSGN(Y2-Y1):SET(X1,Y):NEXT:GOTO350
250 IFY1=Y2FORX=X1TOX2STEPSGN(X2-X1):SET(X,Y1):NEXTELSEA!=ABS((X2-X1)/(Y2-Y1)):I
FA!<=1A!=SGN(X2-X1)*A!:B!=X1:FORY=Y1TOY2STEPSGN(Y2-Y1):SET(B!+.5,Y):B!=B!+A!:NEX
TELSEA!=SGN(Y2-Y1)/A!:B!=Y1:FORX=X1TOX2STEPSGN(X2-X1):SET(X,B!+.5):B!=B!+A!:NEXT
350 NEXT
360 GOTO360' AFTER DRAWING, LOOP HERE
365 REM SUBROUTINE SECTION FOLLOWS
368 REM LINES 370-410 ARE A SUBROUTINE WHICH GETS AND CHECKS X,Y COORDINATES FRO
M THE USER
370 PRINT"
ENTER "QA$"AL POINT'S ";
375 PRINT"COORDINATES? ";:B$="":I=0
380 GOSUB420:Y=ASC(QA$):IFY=13A!=INT(VAL(B$)*100)/100:RETURNELSEIFY=8IFI=0THEN38
0ELSEI=I-1:B$=LEFT$(B$,I):PRINTCHR$(8);:GOTO380
390 IFI=0IFY=72THEN450ELSEIFY=83IFN=0THENCLS:GOTO360ELSE230
400 IFI=6ORY<46OR57<YORY=47THENPRINTCHR$(8);ELSEA!=VAL(B$+QA$):IFA!<128ANDA!-FIX
(A!)<.471THENB$=B$+QA$:I=I+1ELSEPRINTCHR$(8);
410 GOTO380
415 REM LINES 420-445 ARE A SUBROUTINE WHICH GETS A CHARACTER FROM THE KEYBOARD
420 PRINTCHR$(95);
430 QA$=INKEY$
440 QA$=INKEY$:IFQA$<" "ANDQA$<>CHR$(8)ANDQA$<>CHR$(13)THEN440ELSEPRINTCHR$(8);:
IF" "<=QA$PRINTQA$;
445 RETURN
446 QA$=INKEY$' LINE 446 & 447 ARE A PAUSE SUBROUTINE
447 IFINKEY$=""THEN447ELSERETURN
449 REM LINES 450 & 460 PRINT REMINDERS WHEN THE USER ASKS FOR HELP
450 PRINT"
0<=X<=127 AND 0<=Y<=47
ENTER A NUMBER WITH X BEFORE, AND Y AFTER THE DECIMAL. IF Y IS
ONE DIGIT, PUT A ZERO BEFORE IT. FOR X=12 AND Y=8, ENTER '12.08'(WITHOUT QUOTATI
ON MARKS). TO STOP BEFORE ENTERING THE NUMBER OFLINES YOU SPECIFIED, PRESS 'S'."
460 PRINT"PRESS 'H'--FOR HELP.
":GOTO375
```



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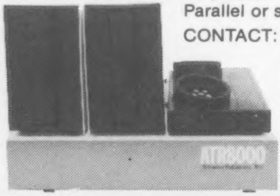

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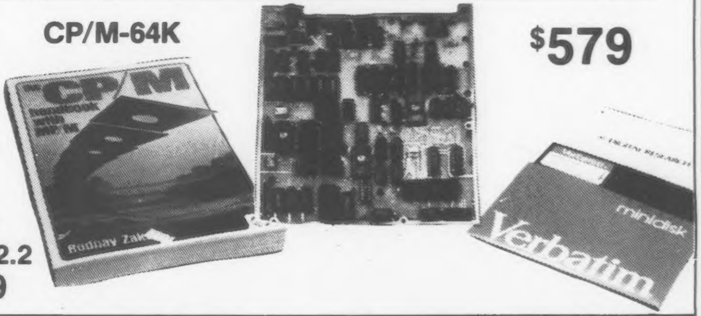

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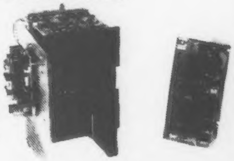

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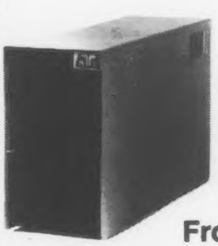

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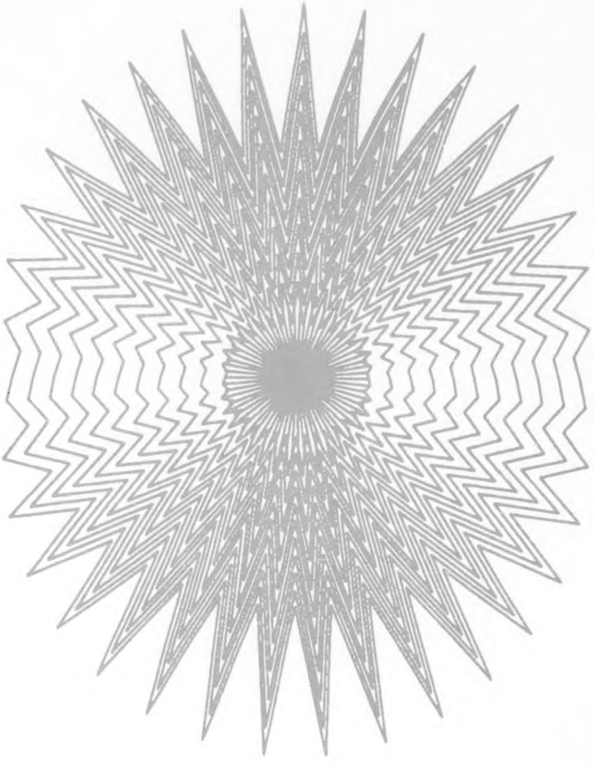
CIRCLE 203 ON READER SERVICE CARD

Part 2

Computer Art For The Tektronix 4052

Joe Jacobson



```
440 REM SECOND SUBROUTINE (N=2)
450 WINDOW -600,600,-600,600
460 R=B*(1+0.25*ABS(COS(L*A)-ABS(SIN(L*A))))
470 RETURN
480 REM THIRD SUBROUTINE (N=3)
490 WINDOW -501,501,-501,501
500 R=B*(1+0.25*ABS(SIN(L*A)))
510 RETURN
520 X=R*COS(A)
530 Y=R*SIN(A)
540 IF A>0 THEN 570
550 MOVE X,Y
560 GO TO 580
570 DRAW X,Y
```

This month I will discuss another polar coordinate program, Sinusoidal Loop Program No. 2. This routine is somewhat similar in structure to Sinusoidal Loop Program No. 1 (*Creative Computing,* January, 1983) and is used the same way. However, the resulting pictures are quite different.

The present program uses three polar coordinate functions that differ from those in the earlier program. Each of these functions is the sum of a constant and a sinusoidal function of the angle. This results in completely new patterns, some of which are visually quite striking.

A Basic source listing and some sample output pictures accompany this article. To use this program you will need a Tektronix 4050 series terminal/computer. However, the algorithm can be adapted for other computer systems if the screen resolution is sufficiently high. Most home computers do not have enough CRT screen resolution; in this case you will need a good mechanical X-Y plotter. Note that the graphics commands (MOVE, DRAW, WINDOW, VIEWPORT) used here are specific to the Tektronix 4050 series computers.

The program is easy to use. It prompts the user, asking for values of the input parameters N, L, D, and G. N selects a polar coordinate function. L is an angular frequency coefficient. D is

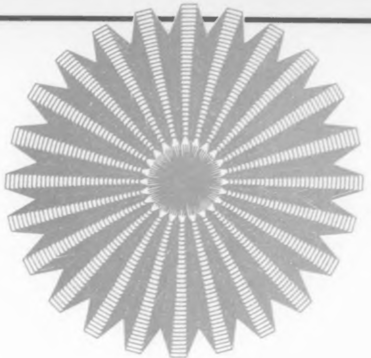
---

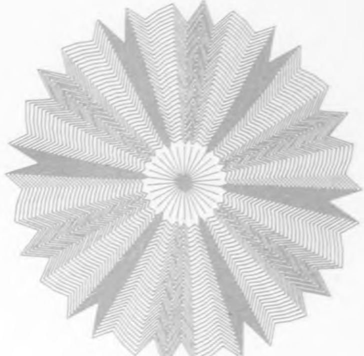
Joe Jacobson, 675 E. Street Road, Apt. 1009, Warminster, PA 18974.

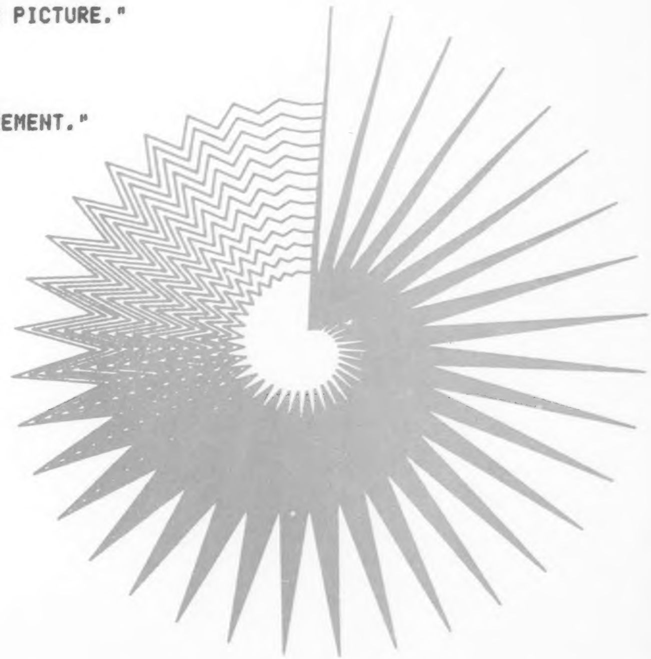
```
580 NEXT A
590 NEXT B
600 FOR C=0 TO L-1 STEP 1
610 R=100
620 T=C*(180/L)
630 X=R*COS(T)
640 Y=R*SIN(T)
650 MOVE X,Y
660 X=R*COS(T+180)
670 Y=R*SIN(T+180)
680 DRAW X,Y
690 NEXT C
700 IF T1=1 THEN 720
710 END
720 WINDOW 0,130,0,100
730 VIEWPORT 0,130,0,100
740 MOVE 0,10
750 PRINT "       SINUSOIDAL LOOP PROGRAM NO. 2 PARAMETERS"
760 MOVE 0,5
770 PRINT "(N,L,D,G) = (";N;",";L;",";D;",";G;")"
780 INPUT J$
```

```
100 REM SINUSOIDAL LOOP PROGRAM NO. 2
110 PAGE
120 SET DEGREES
130 PRINT "ENTER N TO SELECT A SUBROUTINE."
140 PRINT " N MUST BE 1,2, OR 3."
150 INPUT N
160 PRINT "ENTER L TO SELECT A PARTICULAR PICTURE."
170 INPUT L
180 PRINT "ENTER D TO ADJUST SPACING"
190 PRINT "BETWEEN ANGULAR SWEEPS."
200 INPUT D
210 PRINT "ENTER G TO ADJUST ANGULAR INCREMENT."
220 INPUT G
230 PRINT "ENTER T1"
240 INPUT T1
250 IF T1=2 THEN 280
260 VIEWPORT 22,108,14,100
270 GO TO 290
280 VIEWPORT 15,115,0,100
290 PAGE
300 FOR B=100 TO 400 STEP D
310 FOR A=0 TO 360 STEP G
320 IF N=1 THEN 360
330 IF N=2 THEN 380
340 GOSUB 480
350 GO TO 520
360 GOSUB 400
370 GO TO 520
380 GOSUB 440
390 GO TO 520
400 REM FIRST SUBROUTINE (N=1)
410 WINDOW -501,501,-501,501
420 R=B*(1+0.25*SIN(L*A))
430 RETURN
```

```
790 T1=2
800 GO TO 250
```







the increment in radius that is added between angular sweeps. G is the increment within an angular sweep.

When the program asks for a value of the parameter T1, enter a 1 from the keyboard. The picture will be plotted and a list of input parameter values will be printed at the bottom of the screen for future reference. Then clear the screen and hit RETURN, and the same picture will be plotted again, this time without a parameter list.

If you enter a 2 for T1, instead of a 1, you get a "clean" plot (no parameter list) the first time. The program must be run again for each new design you make.

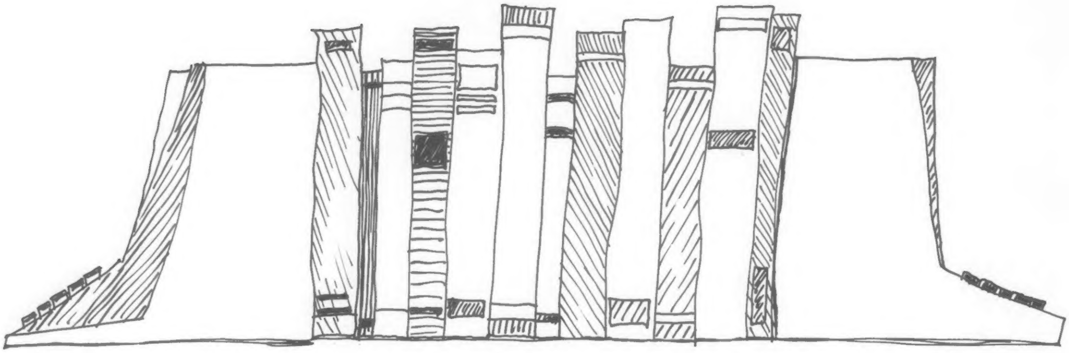
Table 1 lists the ranges of input parameters that I have found to give good designs. However, values outside these intervals may also work well. The patterns seem to repeat for L values larger than about 60 (with G=5). Note that L, D, and G can be decimal fractions, such as L = 16.5. This program is one of several I have recently written. The others will appear in future issues. □

Table 1. Suggested Parameter Values.

Parameter	Range of Values	
	From	To
N*	1	3
L	6	60
D	30	50
G	5	15
T1**	1	2

*N must be 1, 2, or 3.
**T1 must be 1 or 2.

Library Catalog



A Program For Creating A Personal Computer Based Library Catalog

Jeremy M. Hellman

Home, school, and office libraries eventually fall victim to the one characteristic that makes libraries unique; they are the only business whose inventory is constantly growing.

My house is a good example of the problems that this constant expansion can cause. Our living room, master bedroom, children's bedrooms, my office, my wife's study room, the kitchen, and even the dining room are lined with bookshelves. Every year I trudge to the lumber yard for more wood to make more bookshelves.

Through much searching over the years I have gotten a general idea of where different books are kept, and once I even tried to put them on shelves in a systematic fashion. Now, however, most of the systematization has been lost, and it is more a matter of where there is room on the shelf than where the book came from or should be that governs where it will be returned.

Further complicating matters is the fact that many of my bookshelves have been built with shelf spacing that will accommodate only small paperback books. Additional problems arise in looking for a book which has been lent to someone.

Large libraries have traditionally kept track of their books with a card catalog and a system of check out slips to track the books out on loan. The card catalog indexes books in three ways: by title, by author, and by subject. Each nonfiction book is given a catalog number according to either the Dewey Decimal System or the Library of Congress system, and fiction books are catalogued alphabetically by author. Some large libraries have recently implemented computerized check in/check out procedures, but the card catalog is still a universal fixture in most libraries.

Small libraries, those with fewer than 6000 books, have had to either make do with a librarian (usually self-appointed) with a good memory, or implement the full scale card catalog and sign in/sign out systems used by a larger library.

Home libraries, with fewer than 2000 books, usually go without any sort of organization at all. The main price that must be paid for running a small library without any type of catalog and sign out system is not being able to find a particular book when it is wanted. Another is that no record of books owned is available for insurance purposes.

A small computer with a disk drive provides an ideal tool for keeping track of books in a small library. The computer has the ability to store data on large numbers of books and sort the data by title, author, subject, borrower name, or even size, if desired. The availability of small computers in homes, offices, and schools leads to the use of the machine as a book cataloguer.

What The Program Does

The Library Catalog Program described here allows you to create and use a computer based card catalog. It is written for an Apple II+ computer with one disk drive and 48K of memory.

With the Library Catalog Program books can be entered or searched for, records modified, books checked in or out, information on borrowers or borrowed books obtained, and all books in the catalog listed. Data for approximately 1000 books can be placed on a mini-floppy disk. If your library is larger than 1000 volumes, use additional disks for data storage. This program is written to lead you through a file for which data is contained on more than one disk.

The program is versatile. For example, a search by author will turn up all books by the desired author or

---

Jeremy M. Hellman, 336 Coleman Drive, Monroeville, PA 15146.

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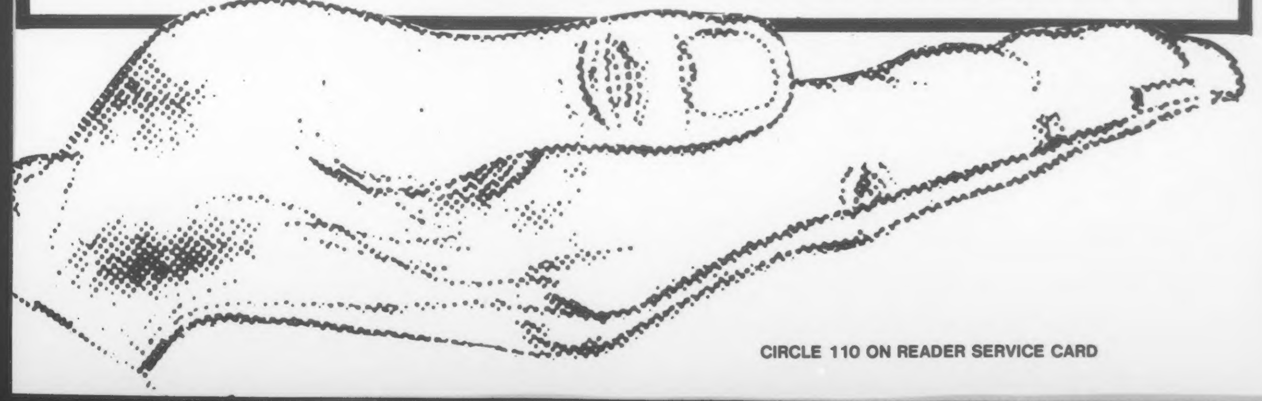

CIRCLE 110 ON READER SERVICE CARD

authors. Thus if you are looking for books by Masters, Library Catalog will turn up all books by Masters as well as those by Masters and Johnson. A search on Masters and Johnson will sort out all those by Masters and Johnson, but not by each author individually. In searches on subject, any of three levels of specialization can be selected. Entries are easily modified, and all output data is presented in readable form.

What sets this program apart from other data base routines is a sequence in which the catalog number of the book is determined. Menus which lead to greater and greater specialization of the book subject matter are provided. The Dewey Decimal System has been used and provides for three levels of detail; the division, the category, and the subcategory. For example, the book *Thermodynamics,* by Sears would be catalogued into the division Pure Science, the category Physics, and the subcategory Heat.

Should a book on the history of science be catalogued under science or history?

A library school graduate would probably have very definite ideas as to exactly how books should be catalogued. For example, should a book on the history of science be catalogued under science or history? Established libraries have a set policy on this type of decision. For an uncatalogued or home library you are the judge and common sense and consistency in assigning numbers will enable a search to turn up all pertinent books.

The program is completely menu driven and all inputs are made as "bomb-proof" as possible. The length of the program is in a large part due to the checking of the validity of each input and an attempt to make the instructions very friendly and clear.

The program is written so that no knowledge of computer programming is necessary to do any of the cataloguing operations. The detailed description of the program given in this article is presented to enable the more advanced programmer to modify the routines, and the beginning programmer to understand the program logic. If your only interest is in cataloguing your library, simply type in the program exactly as listed, and use it as described in the next section.

How To Use The Program

Once you have successfully entered the program and created the data files using the routines supplied, entering books into the catalog can begin.

The first step is to go through the house or library and establish an identification number (ID) consisting of two letters and one digit for each shelf. I use room initial, bookshelf location,

Listing 1.

```
1  REM  THIS PROGRAM IS COPYRIGHT 1982 BY J.M. HELLMAN : 336 COLEMAN DRIVE
     : MONROEVILLE PA 15146 : PHONE 412-372-9004
10  REM   LIBRARY CATALOG MASTER PROGRAM
20  HIMEM: 38400
30 D$ =  CHR$ (4)
40  IF  PEEK (770) = 56 THEN 270
50  HOME : VTAB (5)
60  PRINT  TAB( 8);: INVERSE : PRINT "LIBRARY CATALOG PROGRAM": NORMAL
70  PRINT : PRINT
80  PRINT  TAB( 13);: INVERSE : PRINT "BY J.M. HELLMAN": NORMAL
90  PRINT : PRINT : PRINT
100  PRINT "TYPE ANY KEY TO BEGIN ";: GET T$
110  HOME : VTAB (5)
120  PRINT "THIS PROGRAM WILL CATALOG NEW BOOKS"
130  PRINT "AND SEARCH FOR BOOKS BY TITLE, AUTHOR,"
140  PRINT "SUBJECT, OR A COMBINATION OF THESE KEYS."
150  PRINT
160  PRINT "THE CATALOG IS KEPT IN A FILE"
170  PRINT "WHICH CAN BE ON ONE OR MORE DISKS."
180  PRINT : PRINT
190  PRINT "HOW MANY DISKS CONTAIN CATALOG DATA?"
200  PRINT "ENTER '0' IF JUST STARTING THE CATALOG."
210  INPUT "PRESS 'RETURN' AFTER ENTRY:";DN$
220  FOR I = 1 TO  LEN (DN$)
230  IF  ASC ( MID$ (DN$,I,1)) < 48 OR  ASC ( MID$ (DN$,I,1)) > 57 THEN  PRINT
     : GOTO 190
240  NEXT I
250 DN =  VAL (DN$)
260  POKE 771,DN
270  HOME : VTAB (5)
280  PRINT "DO YOU WANT TO:"
290  PRINT  SPC( 2);"(1)  ENTER BOOKS IN CATALOG"
300  PRINT  SPC( 2);"(2)  SEARCH FOR BOOKS BY"
310  PRINT  SPC( 8);"TITLE, AUTHOR, SUBJECT,"
320  PRINT  SPC( 8);"FICTION TYPE OR CATALOG NO."
330  PRINT  SPC( 2);"(3)  MODIFY AN ENTRY, E.G."
340  PRINT  SPC( 8);"CHECK IN/OUT A BOOK,"
350  PRINT  SPC( 8);"CHANGE SHELF LOCATION"
360  PRINT  SPC( 8);"DELETE AN ENTRY"
370  PRINT  SPC( 8);"OR OTHERWISE MODIFY THE RECORD"
380  PRINT  SPC( 2);"(4)  LIST DATA ON BORROWED BOOKS"
390  PRINT  SPC( 8);"E.G., BOOKS LOANED OUT"
400  PRINT  SPC( 8);"OR BOOKS TO A BORROWER"
410  PRINT  SPC( 2);"(5)  LIST ALL BOOKS IN CATALOG"
420  PRINT  SPC( 2);"(6)  ADD/REMOVE/LIST BOOKSHELVES"
430  PRINT  SPC( 2);"(7)  QUIT THE PROGRAM"
440  PRINT : PRINT "ENTER THE NUMBER OF YOUR SELECTION"
450  PRINT : PRINT "         ";: GET T$
460  PRINT T$
470  IF T$ = "1" THEN 560
480  IF T$ = "2" THEN 550
490  IF T$ = "3" THEN 580
500  IF T$ = "4" THEN 610
510  IF T$ = "5" THEN 630
520  IF T$ = "6" THEN 650
530  IF T$ <  > "7" THEN 270
540  GOTO 670
550  PRINT D$;"RUN CATALOG SEARCH"
560  PRINT
570  PRINT D$;"RUN CATALOG ENTER"
580  PRINT
590  POKE 773,92
600  GOTO 550
610  PRINT
620  PRINT D$,"RUN CATALOG BORROW"
630  PRINT
640  PRINT D$;"RUN CATALOG LIST"
650  PRINT
660  PRINT D$;"RUN CATALOG BOOKSHELF"
670  PRINT D$;"CLOSE"
680  END
```

Listing 2.

```
1  REM  THIS PROGRAM IS COPYRIGHT 1982 BY J.M. HELLMAN : 336 COLEMAN DRIVE
     : MONROEVILLE PA 15146 : TELEPHONE 412-372-9004
10  REM  ***** CATALOG ENTER PROGRAM
20  HIMEM: 38400
30 BL$ = "                                        "
```

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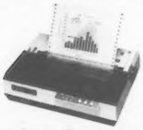

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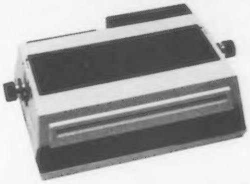

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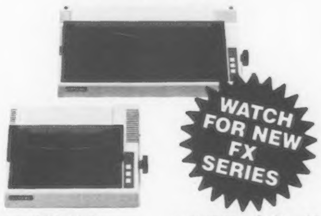

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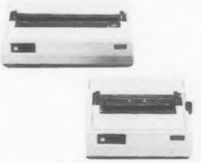

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CIRCLE 244 ON READER SERVICE CARD

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CIRCLE 239 ON READER SERVICE CARD

Library Catalog, continued...

```
40 MT = 0
50 G$ =  CHR$ (7)
60 BN$ =  LEFT$ (BL$,15)
70 BS = 0: REM  BS=0, BOOK ON SHELF;=1 LOANED OUT
80 DC = 5
90 D$ =  CHR$ (4)
100  DIM TL$(DC),AU$(DC),CN$(DC),LC$(DC),TP$(DC),SZ$(DC),F$(10)
110  FOR I = 1 TO 6
120  READ F$(I)
130  NEXT I
140  DATA   "NOVEL","ACTION/MYSTERY","WESTERN","SCIENCE FICTION","SHORT ST
     ORY/COLLECTION","CHILDREN'S LITERATURE"
150  ONERR  GOTO 2030
160  HOME : VTAB (3)
170  PRINT "NON-FICTION BOOKS IN THE DEWEY DECIMAL": PRINT "SYSTEM ARE CAT
     ALOGED IN 1000"
180  PRINT "CATEGORIES: 10 DIVISIONS;": PRINT  SPC( 12);"10 CATEGORIES/DIV
     ISION;": PRINT  SPC( 12);"10 SUBCATEGORIES/CATEGORY"
190  PRINT : PRINT : PRINT "FICTION BOOKS IN THE PROGRAM ARE": PRINT "CATA
     LOGED IN THE FOLLOWING DIVISIONS:"
200  PRINT  SPC( 12);"NOVEL": PRINT  SPC( 12);"ACTION/MYSTERY": PRINT  SPC
     (12);"WESTERN": PRINT  SPC( 12);"SCIENCE FICTION": PRINT  SPC( 12);"SH
     ORT STORY/COLLECTION": PRINT  SPC( 12);"CHILDREN'S LITERATURE"
210  PRINT : PRINT "CATALOG CLASSIFICATIONS ARE NOW": PRINT "BEING READ IN
     TO THE COMPUTER": PRINT
220  PRINT D$;"OPEN SHELF"
230  PRINT D$;"READ SHELF"
240  INPUT NS
250  PRINT D$
260  IF NS = 0 THEN  PRINT : PRINT "NO SHELF I.D.'S ARE ON FILE": FOR I =
     1 TO 2000: NEXT I: GOSUB 2020
270  DIM LL$(NS,1)
280  PRINT D$;"READ SHELF"
290  FOR I = 1 TO NS: INPUT LL$(I,0): INPUT LL$(I,1): NEXT I
300  PRINT D$;"CLOSE SHELF"
310  DIM SC$(9,100)
320  DIM NA(DC)
330  FOR I = 0 TO 9
340 SC$(I,0) =  STR$ (I)
350  PRINT D$;"OPEN SC SEQ LIST ";I
360  PRINT D$;"READ SC SEQ LIST ";I
370  FOR J = 1 TO 100: INPUT SC$(I,J): NEXT J
380  PRINT D$;"CLOSE"
390  NEXT I
400  HIMEM: 20000
410 DN =  PEEK (771)
420  PRINT "INSERT DISK FOR CATALOG DATA STORAGE.": PRINT "PRESS ANY KEY
     WHEN YOU ARE READY. ";: GET T$
430  PRINT
440  PRINT
450  PRINT D$;"OPEN LIBREC-120,L120"
460  PRINT D$;"READ LIBREC-120,R0"
470  INPUT RN
480  PRINT D$
490  PRINT : PRINT "THIS DISK CONTAINS ";RN;" BOOK RECORDS.": PRINT : FOR
     I = 1 TO 1000: NEXT I
500  REM   *** RN=NUMBER OF BOOKS ON FILE
510  REM   *** DN=NUMBER OF DISKS CONTAINING RECORDS
520 DD = 1: REM     **** DD=DISK             COUNTER
530 BC = 0: REM  BC= COUNTER IN GROUPS OF DC
540 BC = BC + 1
550  HOME : VTAB (5): INVERSE
560  PRINT "TITLE:";: NORMAL : INPUT " ";TL$
570  PRINT : PRINT
580  INVERSE : PRINT "AUTHOR(S) LAST (/LAST/...) NAME(S)": PRINT "NO COMMAS
     OR SPACES, PLEASE!!": NORMAL : PRINT
590  PRINT "5 NAMES MAXIMUM PER BOOK": PRINT : INVERSE
600  PRINT "EXAMPLES:";: NORMAL
610  PRINT "  SHAKESPEARE"
620  PRINT "            MASTERS/JOHNSON"
630  PRINT "            WESTERN-WRITERS-OF-AMERICA"
640  PRINT
650  INPUT "   ";AU$: IF  LEN (AU$) > 40 THEN AU$ =  LEFT$ (AU$,40): IF  ASC
     ( RIGHT$ (AU$,1)) = 47 THEN AU$ =  LEFT$ (AU$,39)
660 NA = 1
670  FOR I = 1 TO  LEN (AU$): IF  ASC ( MID$ (AU$,I,1)) = 47 THEN NA = NA +
     1: IF NA = 6 THEN NA = NA - 1:AU$ =  LEFT$ (AU$,I - 1):I = 45
680  NEXT I
690  PRINT
700  INVERSE : PRINT : PRINT "ENTER BOOK HEIGHT": NORMAL : PRINT  TAB( 3);
     : INVERSE : PRINT "(S)MALL - (N)ORMAL - (T)ALL";: NORMAL : PRINT "  "
     ;: GET SZ$: PRINT SZ$
710 SZ =  ASC (SZ$)
720  IF SZ = 83 THEN 760
730  IF SZ = 84 THEN 760
740  IF SZ = 78 THEN 760
750  PRINT : GOTO 700
760  PRINT : PRINT
770  INVERSE : PRINT "LOCATION - ROOM,CASE,SHELF:";: NORMAL : INPUT "  ";LC$
780  PRINT
```

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CIRCLE 122 ON READER SERVICE CARD

and shelf number. For example, the ID of a bookshelf with the description "Melissa's room, desk bookshelf, top shelf" would be MD1.

Run Catalog Master, and the computer will ask for the number of disks containing catalog data (zero in this initial case), and the menu shown in Figure 1 will appear on the screen. Select the bookshelf option (6), and a new menu will appear (Figure 2). Choose (1) to add shelves to the library, and follow the instructions to supply ID, size (S-short; N-normal; T-tall), and location description. When all shelves are entered, return to the menu and select (4), END SHELF OPERATIONS.

Figure 1. The primary menu.

```
DO YOU WANT TO:
      (1)  ENTER BOOKS IN CATALOG
      (2)  SEARCH FOR BOOKS BY
             TITLE, AUTHOR, SUBJECT,
             FICTION TYPE OR CATALOG NO.
      (3)  MODIFY AN ENTRY, E.G.
             CHECK IN/OUT A BOOK
             CHANGE SHELF LOCATION
             DELETE AN ENTRY
             OR OTHERWISE MODIFY THE RECORD
      (4)  LIST DATA ON BORROWED BOOKS
             E.G. BOOKS LOANED OUT
             OR BOOKS TO A BORROWER
      (5)  LIST ALL BOOKS IN CATALOG
      (6)  ADD/REMOVE/LIST BOOKSHELVES
      (7)  QUIT THE PROGRAM

ENTER THE NUMBER OF YOUR SELECTION
```

Figure 2. The bookshelf menu.

```
     BOOKSHELF IDENTIFICATION PROGRAM

DO YOU WISH TO

      (1)  ADD SHELVES TO THE LIBRARY

      (2)  REMOVE SHELVES FROM LIBRARY

      (3)  GET A SHELF DIRECTORY

      (4)  END SHELF OPERATIONS

ENTER THE NUMBER OF YOUR SELECTION
```

The primary menu will appear once more, and selection (1) will permit book entry. A message asking you to replace the Catalog Master disk with a disk for book data storage will appear. When this is done the program will tell you how many books are currently in storage on the disk. Once again, it is zero in this initial case.

The computer then requests title, author, location ID, and whether the book is fiction or nonfiction. If the book is nonfiction, the cataloguing process proceeds. For example, the book *I Hear America Talking* would

```
790  IF  LEN (LC$) <  > 3 THEN 770
800  IF  ASC ( LEFT$ (LC$,1)) < 65 OR  ASC ( LEFT$ (LC$,1)) > 90 GOTO 770
810  IF  ASC ( MID$ (LC$,2,1)) < 65 OR  ASC ( MID$ (LC$,2,1)) > 90 GOTO 770
820  IF  ASC ( RIGHT$ (LC$,1)) < 48 OR  ASC ( RIGHT$ (LC$,1)) > 57 GOTO 770
830 HI = 0: FOR ZY = 1 TO NS: IF LC$ = LL$(ZY,0) THEN HI = 1:ZZ =  ASC (LL
     $(ZY,1)):ZY = NS + 1
840  NEXT ZY
850  IF HI = 0 THEN  PRINT "SHELF GIVEN IS NOT ON FILE": PRINT "DO YOU WANT
     A SHELF DIRECTORY (Y/N)? ";: GET T$: PRINT : IF T$ = "Y" THEN  GOSUB
     2300
860  IF HI = 0 THEN  PRINT : GOTO 770
870 WF = 0: IF SZ = 84 AND ZZ = 83 THEN WF = 1
880  IF SZ = 84 AND ZZ = 78 THEN WF = 1
890  IF SZ = 78 AND ZZ = 83 THEN WF = 1
900  IF WF = 1 THEN  PRINT "BOOK TOO TALL FOR SHELF": PRINT "DO YOU WANT A
      SHELF DIRECTORY (Y/N)? ";: GET T$: PRINT : IF T$ = "Y" THEN  GOSUB
      2300
910  IF WF = 1 THEN  PRINT : GOTO 770
920  INVERSE : PRINT "FICTION OR NON-FICTION (F/N)?";: NORMAL : PRINT " ";
     : GET TP$
930  PRINT TP$
940  IF TP$ = "F" GOTO 1300
950  IF TP$ <  > "N" THEN  PRINT : GOTO 920
960  HOME
970  VTAB (3): PRINT  SPC( 15);"DIVISIONS": PRINT : PRINT
980  FOR I = 0 TO 9
990  PRINT I;"   ";SC$(I,1)
1000  NEXT I
1010  PRINT
1020  PRINT "ENTER DIVISION NUMBER ";: GET T$: PRINT T$
1030  IF  ASC (T$) < 48 OR  ASC (T$) > 57 THEN  PRINT : GOTO 960
1040 DV =  VAL (T$)
1050  HOME : VTAB (3)
1060  PRINT "DIVISION: ";SC$(DV,1)
1070  PRINT
1080  FOR I = 0 TO 9
1090  PRINT I;"  ";SC$(DV,(I * 10) + 1)
1100  NEXT I
1110  PRINT : PRINT
1120  PRINT "ENTER CATEGORY NUMBER"; SPC( 25);"OR 'X' FOR DIVISION LISTING :",
      GET C$: PRINT C$
1130  IF C$ = "X" GOTO 960
1140  IF  ASC (C$) < 48 OR  ASC (C$) > 57 THEN  PRINT : GOTO 1120
1150  HOME : VTAB (3): PRINT "CATEGORY: ";SC$(DV,( VAL (C$) * 10) + 1)
1160  PRINT
1170  FOR I = 1 TO 10: PRINT I - 1; SPC( 2);SC$(DV,10 *  VAL (C$) + I): NEXT I
1180  PRINT
1190  PRINT "ENTER SUBCATEGORY NUMBER"; SPC( 25);"OR 'X' FOR CATEGORY LIST
     ING ";: GET S$: PRINT S$
1200  PRINT
1210  IF S$ = "X" GOTO 1050
1220  IF  ASC (S$) < 48 OR  ASC (S$) > 57 THEN 1190
1230 S$ =  STR$ ( VAL (S$) + 1)
1240 CN = DV * 100 +  VAL (C$) * 10 +  VAL (S$) - 1
1250  IF CN < 10 THEN CN$ = "00" +  STR$ (CN): GOTO 1280
1260  IF CN < 100 THEN CN$ = "0" +  STR$ (CN): GOTO 1280
1270 CN$ =  STR$ (CN)
1280  GOSUB 1520
1290  GOTO 1430
1300  HOME : VTAB (5)
1310  PRINT "FICTION"
1320  PRINT : PRINT
1330  FOR I = 1 TO 6
1340  PRINT I; SPC( 2);F$(I)
1350  NEXT I
1360  PRINT : PRINT
1370  PRINT "ENTER CATEGORY NUMBER: ";: GET T$: PRINT T$
1380  IF  ASC (T$) < 49 OR  ASC (T$) > 54 THEN  PRINT : GOTO 1300
1390 FC =  VAL (T$)
1400 CN = FC * 100
1410  GOSUB 1520
1420 CN$ =  STR$ (CN)
1430 TL$(BC) = TL$:AU$(BC) = AU$:CN$(BC) = CN$:LC$(BC) = LC$:TP$(BC) = TP$
     :SZ$(BC) = SZ$
1440 NA(BC) = NA
1450  IF BC = DC THEN  GOSUB 1770:BC = 0
1460  PRINT : PRINT "ENTER 'C' FOR NEXT BOOK"
1470  PRINT "ENTER 'Q' TO END BOOK ENTRY"
1480  PRINT  SPC( 10): GET T$: PRINT
1490  IF T$ = "Q" AND BC = 0 THEN  GOSUB 1970
1500  IF T$ = "Q" THEN  GOSUB 1770
1510  GOTO 540
1520  REM    ***** SUBROUTINE TO PRINT ENTRY FOR CHECK
1530  HOME : VTAB (3)
1540  PRINT "TITLE: ";TL$: PRINT
1550  PRINT "AUTHOR: ";AU$: PRINT
1560  PRINT "NUMBER OF AUTHORS: ";NA: PRINT
1570  PRINT "LOCATION: ";LC$: PRINT
1580  IF SZ$ = "N" THEN  PRINT "BOOK HEIGHT: NORMAL": PRINT : GOTO 1610
1590  IF SZ$ = "S" THEN  PRINT "BOOK HEIGHT: SMALL": PRINT : GOTO 1610
1600  PRINT "BOOK HEIGHT: TALL": PRINT
```

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All of the Adventures in this ad are in Basic. They are full featured, fully plotted adventures that will take a minimum of thirty hours (in several sittings) to play.

Adventuring requires 16k on Sinclair, TRS-80, and TRS-80 Color. They require 8k on OSI and 13k on VIC-20. Sinclair requires extended BASIC.

TREK ADVENTURE by Bob Retelle — This one takes place aboard a familiar starship and is a must for trekkies. The problem is a familiar one — The ship is in a "decaying orbit" (the Captain never could learn to park!) and the engines are out (You would think that in all those years, they would have learned to build some that didn't die once a week). Your options are to start the engine, save the ship, get off the ship, or die. Good Luck.

Authors note to players — I wrote this one with a concordance in hand. It is very accurate — and a lot of fun. It was nice to wander around the ship instead of watching it on T.V.

CIRCLE WORLD by Bob Anderson — The Alien culture has built a huge world in the shape of a ring circling their sun. They left behind some strange creatures and a lot of advanced technology. Unfortunately, the world is headed for destruction and it is your job to save it before it plunges into the sun!

Editors note to players — In keeping with the large scale of Circle World, the author wrote a very large adventure. It has a lot of rooms and a lot of objects in them. It is a very convoluted, very complex adventure. One of our largest. Not available on OSI.

HAUNTED HOUSE by Bob Anderson — This one is for the kids. The house has ghosts, goblins, vampires and treasures — and problems designed for the 8 to 13 year old. This is a real adventure and does require some thinking and problem solving — but only for kids.

Authors note to players—This one was fun to write. The vocabulary and characters were designed for younger players and lots of things happen when they give the computer commands. This one teaches logical thought, mapping skills, and creativity while keeping their interest.

DERELICT by Rodger Olsen and Bob Anderson — For Wealth and Glory, you have to ransack a thousand year old space ship. You'll have to learn to speak their language and operate the machinery they left behind. The hardest problem of all is to live through it.

Authors note to players — This adventure is the new winner in the "Toughest Adventure at Aardvark Sweepstakes". Our most difficult problem in writing the adventure was to keep it logical and realistic. There are no irrational traps and sudden senseless deaths in Derelict. This ship was designed to be perfectly safe for its' builders. It just happens to be deadly to alien invaders like you.

NUCLEAR SUB by Bob Retelle — You start at the bottom of the ocean in a wrecked Nuclear Sub. There is literally no way to go but up. Save the ship, raise her, or get out of her before she blows or start WWIII.

Editors note to players—This was actually plotted by Rodger Olsen, Bob Retelle, and someone you don't know — Three of the nastiest minds in adventure writing. It is devious, wicked, and kills you often. The TRS-80 Color version has nice sound and special effects.

EARTHQUAKE by Bob Anderson and Rodger Olsen — A second kids adventure. You are trapped in a shopping center during an earthquake. There is a way out, but you need help. To save yourself, you have to be a hero and save others first.

Authors note to players — This one feels good. Not only is it designed for the younger set (see note on Haunted House), but it also plays nicely. Instead of killing, you have to save lives to win this one. The player must help others first if he/she is to survive — I like that.

PYRAMID by Rodger Olsen — This is one of our toughest Adventures. Average time through the Pyramid is 50 to 70 hours. The old boys who built this Pyramid did not mean for it to be ransacked by people like you.

Authors note to players — This is a very entertaining and very tough adventure. I left clues everywhere but came up with some ingenous problems. This one has captivated people so much that I get calls daily from as far away as New Zealand and France from bleary eyed people who are stuck in the Pyramid and desperate for more clues.

QUEST by Bob Retelle and Rodger Olsen — THIS IS DIFFERENT FROM ALL THE OTHER GAMES OF ADVENTURE!!!! It is played on a computer generated map of Alesia. You lead a small band of adventurers on a mission to conquer the Citadel of Moorlock. You have to build an army and then arm and feed them by combat, bargaining, exploration of ruins and temples, and outright banditry. The game takes 2 to 5 hours to play and is different each time. The TRS-80 Color version has nice visual effects and sound. Not available on OSI. This is the most popular game we have ever published.

MARS by Rodger Olsen — Your ship crashed on the Red Planet and you have to get home. You will have to explore a Martian city, repair your ship and deal with possibly hostile aliens to get home again.

Authors note to players — This is highly recommended as a first adventure. It is in no way simple—playing time normally runs from 30 to 50 hours — but it is constructed in a more "open" manner to let you try out adventuring and get used to the game before you hit the really tough problems.

ADVENTURE WRITING/DEATHSHIP by Rodger Olsen — This is a data sheet showing how we do it. It is about 14 pages of detailed instructions how to write your own adventures. It contains the entire text of Deathship. Data sheet - $3.95. NOTE: Owners of OSI, TRS-80, TRS-80 Color, and Vic 20 computers can also get Deathship on tape for an additional $5.00.

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produce the set of classification data shown in Figures 3a, 3b, and 3c as selections 4, 2, and 1 were chosen to catalog the book as Written and Spoken English, catalog number 421. If the book had been fiction, the menu shown in Figure 3d would have been displayed.

Figure 3a. The division menu.

```
                DIVISIONS

0   GENERALITIES
1   PHILOSOPHY & REL DISCIPLINES
2   RELIGION
3   SOCIAL SCIENCES
4   LANGUAGE
5   PURE SCIENCES
6   TECHNOLOGY (APPLIED SCIENCE)
7   THE ARTS
8   LITERATURE (BELLES - LETTRES)
9   GENERAL GEOG & HIST

ENTER DIVISION NUMBER
```

Figure 3b. The category menu.

```
DIVISION: LANGUAGE

0  LANGUAGE
1  LINGUISTICS
2  ENGLISH & ANGLO-SAXON LANGS
3  GERMANIC LANGS
4  ROMANCE LANGS- FRENCH
5  ITAL- ROMANIAN- RHAETO-ROMANIC
6  SPANISH & PORT LANGS
7  ITALIC LANGS - LATIN
8  HELLENIC LANGS-CLASSICAL GREEK
9  OTHER LANGS

ENTER CATEGORY NUMBER
      OR 'X' FOR DIVISION LISTING
```

Figure 3c. The subcategory menu.

```
CATEGORY: ENGLISH & ANGLO-SAXON LANGS

0  ENGLISH & ANGLO-SAXON LANGS
1  WRITTEN & SPOKEN ENG
2  ENG ETYMOLOGY
3  ENG DICTIONARIES
4  *
5  ENG STRUCTURAL SYSTEM
6  *
7  NONSTANDARD ENG
8  STANDARD ENG USAGE
9  ANGLO-SAXON (OLD ENG)

ENTER SUBCATEGORY NUMBER
         OR 'X' FOR CATEGORY LISTING
```

Figure 3d.
Catalog menu for fiction books.

```
FICTION

1  NOVEL
2  ACTION/MYSTERY
3  WESTERN
4  SCIENCE FICTION
5  SHORT STORY/COLLECTION
6  CHILDREN'S LITERATURE

ENTER CATEGORY NUMBER:
```

```
1610  IF TP$ = "F" THEN  PRINT "BOOK TYPE: FICTION": PRINT : GOTO 1700
1620  PRINT "BOOK TYPE: NON-FICTION": PRINT
1630  PRINT "DIVISION: ";SC$(DV,1): PRINT
1640  PRINT "CATEGORY: ";SC$(DV,( VAL (C$) * 10) + 1)
1650  PRINT
1660  PRINT "SUBCATEGORY: ";SC$(DV,10 *  VAL (C$) +  VAL (S$))
1670  PRINT : PRINT "CATALOG NUMBER: ";CN$
1680  PRINT
1690  GOTO 1710
1700  PRINT "CATEGORY: "F$(FC): PRINT
1710  PRINT "ENTER 'X' TO RE-ENTER THIS BOOK;"
1720  PRINT "ENTER ANY OTHER KEY TO CONTINUE. ";
1730  GET T$
1740  PRINT : PRINT
1750  IF T$ = "X" THEN  POP : GOTO 550
1760  RETURN
1770  REM  ***** SUBROUTINE TO WRITE DATA TO DISK
1780  IF BC = 0 THEN  RETURN
1790  PRINT D$
1800  FOR J = 1 TO BC
1810 RN = RN + 1
1820  IF  LEN (TL$(J)) < 40 THEN TL$(J) = TL$(J) +  LEFT$ (BL$,40 -  LEN
     (TL$(J)))
1830 TL$(J) =  LEFT$ (TL$(J),40)
1840  IF  LEN (AU$(J)) < 40 THEN AU$(J) = AU$(J) +  LEFT$ (BL$,40 -  LEN
     (AU$(J)))
1850 AU$(J) =  LEFT$ (AU$(J),40)
1860  PRINT D$;"WRITE LIBREC-120,R";RN
1870  PRINT TL$(J): PRINT AU$(J): PRINT TP$(J): PRINT CN$(J): PRINT LC$(J)
     : PRINT SZ$(J)
1880  PRINT NA(J)
1890  PRINT BS: PRINT BN$
1900  PRINT D$
1910  NEXT J
1920  PRINT D$;"WRITE LIBREC-120,R0"
1930  PRINT RN
1940  PRINT D$
1950  IF T$ = "Q" THEN 1970
1960  RETURN
1970  PRINT D$;"CLOSE"
1980  HOME : VTAB (8): PRINT "RETURN 'CATALOG MASTER' DISK TO DRIVE."
1990  PRINT : PRINT "PRESS ANY KEY WHEN YOU ARE READY. ";: GET T$
2000  PRINT
2010  HIMEM: 38400
2020  POP : HOME : POKE 770,56: PRINT D$;"RUN CATALOG MASTER"
2030  REM   ***** ERROR ROUTINE TO PREPARE NEW DISK
2040 ER =  PEEK (222)
2050  IF ER = 5 THEN 2120
2060  IF ER = 8 OR ER = 9 OR ER = 4 THEN 2080
2070  GOTO 2110
2080  PRINT : PRINT G$;G$;G$;"******* DISK CANNOT ACCEPT DATA *******"
2090  PRINT  SPC( 5);"CHECK DRIVE DOOR AND/OR INSERT": PRINT "INITIALIZED
     DISK WITH SPACE FOR STORAGE"
2100  PRINT  SPC( 4);"DISK MUST NOT BE WRITE PROTECTED!":MT = 1: GOTO 2200
2110  PRINT "ERROR FOUND CODE ";ER: PRINT "ON LINE "; PEEK (218) +  PEEK
     (219) * 256: END
2120  PRINT D$;"OPEN LIBREC-120,L120"
2130  PRINT D$;"WRITE LIBREC-120,R0"
2140 NN = 0
2150  PRINT NN
2160  PRINT D$;"CLOSE"
2170 DN = DN + 1: POKE 771,DN
2180  IF MT = 1 THEN 2210
2190  GOTO 450
2200  PRINT : PRINT "PRESS ANY KEY WHEN YOU ARE READY ";: GET M$: PRINT : PRINT

2210  PRINT D$;"OPEN LIBREC-120,L120"
2220  PRINT D$;"READ  LIBREC-120,R0"
2230  INPUT RN
2240  PRINT D$
2250  PRINT : PRINT "THIS DISK CONTAINS ";RN;" BOOK RECORDS.": FOR LV = 1 TO
     1000: NEXT LV: PRINT
2260 MT = 0
2270  IF BC = DC THEN 1450
2280  IF T$ = "Q" THEN 1500
2290  GOTO 450
2300  REM  SUBROUTINE FOR SHELF DIRECTORY
2310  HOME : VTAB (5)
2320  PRINT  SPC( 12);"SHELF DIRECTORY"
2330  PRINT : PRINT
2340  FOR ZW = 1 TO NS
2350  PRINT  SPC( 7);"ID =  ";LL$(ZW,0); SPC( 5);"SHELF SIZE= ";LL$(ZW,1)
2360  FOR ZV = 1 TO 500: NEXT ZV
2370  NEXT ZW
2380  PRINT : PRINT "RERUN DIRECTORY (Y/N)? ";: GET T$: PRINT
2390  IF T$ = "Y" THEN 2300
2400  HOME : VTAB (5)
2410  INVERSE : PRINT "TITLE:";: NORMAL : PRINT " ";TL$: PRINT
2420  INVERSE : PRINT "AUTHOR:";: NORMAL : PRINT " ";AU$: PRINT
2430  INVERSE : PRINT "BOOK HEIGHT:";: NORMAL : PRINT " ";SZ$: PRINT
2440  RETURN
```

Library Catalog, continued...

At this time a listing of all the data typed in for the book is presented (Figure 4), and you are given the opportunity to make changes. When the entry is correct, the next book is entered. When all books have been entered, the primary menu is once more displayed.

Figure 4. Listing for checking entry.

```
TITLE: I HEAR AMERICA TALKING

AUTHOR: FLEXNER

NUMBER OF AUTHORS: 1

LOCATION: JE3

BOOK HEIGHT: TALL

BOOK TYPE: NON-FICTION

DIVISION: LANGUAGE

CATEGORY: ENGLISH & ANGLO SAXON LANGS

SUBCATEGORY: WRITTEN & SPOKEN ENG

CATALOG NUMBER: 421

ENTER 'X' TO RE-ENTER THIS BOOK
ENTER ANY OTHER KEY TO CONTINUE
```

Figure 5. Menu for book search.

```
DO YOU WISH TO:
      1  SEARCH ON TITLE
      2  SEARCH ON AUTHOR
      3  SEARCH ON SUBJECT/FICTION TYPE
      4  SEARCH ON CATALOG NUMBER
      5  END SEARCH

ENTER THE NUMBER OF YOUR CHOICE
```

Figure 6.
Menu for borrowing information.

```
DO YOU WISH TO LIST
     (1) ALL BOOKS LOANED OUT
     (2) BOOKS LOANED TO A GIVEN PERSON

  OR (3) END THE SEARCH

ENTER THE NUMBER OF YOUR SELECTION
```

When all books are entered, the Library Catalog Program can be used for searches, recording borrowed and returned books, and listing all books on file. The menu for searches is shown in Figure 5.

If the SUBJECT/FICTION TYPE selection is made, the classifications are once again presented to aid in subject selection. For information on borrowing, the menu shown in Figure 6 enables several selections. Option 3 from the main menu, permits any record to be modified, from check in/check out to correction of spelling to complete deletion of the book from the file.

Listing 3.

```
1  REM  THIS PROGRAM IS COPYRIGHT 1982 BY J.M. HELLMAN : 336 COLEMAN DRIVE
     : MONROEVILLE PA 15146 : PHONE 412-372-9004
10  REM    *** CATALOG SEARCH PROGRAM
20 BL$ = "                                            "
30 D$ =  CHR$ (4)
40 MOD = 0
50  PRINT D$
60  IF  PEEK (773) = 92 THEN MOD = 1
70  POKE 773,0
80 BR$ = "- - - - - - - - - - - - - - - - - - - - - - -"
90  HOME : VTAB (10)
100  POKE 770,56
110 DN =  PEEK (771)
120  ONERR  GOTO 3770
130  DIM SC$(9,100),F$(6)
140  DIM AM$(5),NM$(4)
150  IF MOD = 1 THEN  HIMEM: 20000:D$ =  CHR$ (4): GOTO 400
160  PRINT  SPC( 9);: INVERSE : PRINT "CATALOG SEARCH PROGRAM": NORMAL
170  PRINT : PRINT : PRINT "CATALOG CLASSIFICATION DATA": PRINT "IS NOW BE
     ING ENTERED INTO THE COMPUTER."
180  FOR I = 0 TO 9
190 SC$(I,0) =  STR$ (I)
200  PRINT D$;"OPEN SC SEQ LIST ";I
210  PRINT D$;"READ SC SEQ LIST ";I
220  FOR J = 1 TO 100: INPUT SC$(I,J): NEXT J
230  PRINT D$;"CLOSE"
240  NEXT I
250  HIMEM: 20000
260 F$(1) = "NOVEL":F$(2) = "ACTION/MYSTERY":F$(3) = "WESTERN":F$(4) = "SC
     IENCE FICTION":F$(5) = "SHORT STORY/COLLECTION":F$(6) = "CHILDREN'S
     LITERATURE"
270  NORMAL : HOME : VTAB (5)
280  HOME : VTAB (5)
290  PRINT D$
300  PRINT "DO YOU WISH TO:"
310  PRINT  SPC( 6);"1  SEARCH ON TITLE"
320  PRINT  SPC( 6);"2  SEARCH ON AUTHOR"
330  PRINT  SPC( 6);"3  SEARCH ON SUBJECT/FICTION TYPE"
340  PRINT  SPC( 6);"4  SEARCH ON CATALOG NUMBER"
350  PRINT  SPC( 6);"5  END SEARCH"
360  PRINT : PRINT "ENTER THE NUMBER OF YOUR CHOICE ";: GET CH$: PRINT CH$

370  IF  ASC (CH$) < 49 OR  ASC (CH$) > 54 THEN 360
380 CH =  VAL (CH$)
390  ON CH GOTO 400,810,1470,2190,2260
400  HOME : VTAB (5):DD = 1:HI = 0
410  PRINT "ENTER BOOK TITLE:"
420  INPUT "      ";TT$
430 LT =  LEN (TT$): IF LT > 40 THEN TT$ =  LEFT$ (TT$,40)
440  REM  ****** START SEARCH
450  PRINT : PRINT "INSERT CATALOG DATA DISK # ";DD;" IN DRIVE"
460  PRINT : PRINT "PRESS ANY KEY WHEN YOU ARE READY"
470  GET T$: PRINT
480  HOME : VTAB (10)
490  PRINT  SPC( 15);: INVERSE : PRINT "SEARCHING": NORMAL
500  PRINT D$;"OPEN   LIBREC-120,L120"
510  PRINT D$;"READ LIBREC-120,R0"
520  INPUT RN
530  PRINT D$
540  IF RN = 0 THEN  PRINT "NO BOOKS ON FILE ON THIS DISK.": GOTO 730
550  PRINT : PRINT "THIS DISK CONTAINS ";RN;" BOOK RECORDS.": PRINT
560  FOR I = 1 TO RN
570 TE = 0
580  PRINT D$;"READ LIBREC-120,R";I
590  INPUT TL$
600  PRINT D$
610  IF  LEFT$ (TL$,LT) = TT$ THEN HI = 1: NORMAL :TE = 1: GOSUB 2330: IF
     MOD <  > 1 THEN  PRINT "CONTINUE SEARCH (Y/N)? ";: GET X$: PRINT X$: IF
     X$ = "N" THEN 270
620  IF TE = 0 THEN 710
630  IF MOD <  > 1 THEN 710
640  PRINT D$: PRINT : PRINT : PRINT : PRINT
650  PRINT : PRINT "DO YOU WANT TO  1  MODIFY": PRINT  SPC( 16);"2  DELETE
     ": PRINT  SPC( 16);"3  LEAVE UNCHANGED": PRINT "THIS BOOK RECORD.": PRINT
     "ENTER SELECTION NUMBER: ";
660  GET Q$: PRINT Q$:Q =  VAL (Q$)
670  IF Q = 1 THEN  GOTO 2830
680  IF Q = 2 THEN 3570
690  IF Q = 3 THEN 3520
700  PRINT "INVALID SELECTION. TRY AGAIN.": GOTO 650
710  NEXT I
720  PRINT D$
730 DD = DD + 1
740  IF DD > DN THEN  NORMAL : GOTO 770
750  PRINT D$
760  GOTO 450
```

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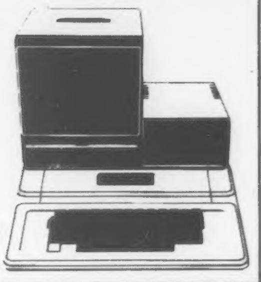

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Library Catalog, continued...

```
770  IF HI = 1 AND MOD = 1 THEN  GOTO 3540
780  IF HI = 1 THEN  PRINT D$: PRINT : PRINT "THIS IS THE END OF THIS SEARCH."
     : PRINT "PRESS ANY KEY TO CONTINUE. ": GET KK$: PRINT : PRINT : GOTO 280
790  GOSUB 3720
800  GOTO 280
810  HOME : VTAB (5):DD = 1:HI = 0: FOR I = 0 TO 4:NM$(I) = "": NEXT I
820 BL$ = "                                                  "
830  PRINT "ENTER AUTHOR(S) LAST (/LAST/...) NAME(S)"
840  PRINT "NO COMMAS OR SPACES, PLEASE!"
850  PRINT "EXAMPLES:  SHAKESPEARE"
860  PRINT "           MASTERS/JOHNSON"
870  PRINT : INPUT "      ";AA$
880  IF  LEN (AA$) > 40 THEN AA$ =  LEFT$ (AA$,40)
890  IF  LEN (AA$) < 40 THEN AA$ = AA$ +  LEFT$ (BL$,40 -  LEN (AA$))
900 N$ = "":NN = 1
910  FOR I = 1 TO 40
920 A$ =  MID$ (AA$,I,1)
930  IF  ASC (A$) = 47 THEN NN = NN + 1:NM$(NN - 2) = N$:N$ = "": GOTO 960
940  IF  ASC (A$) = 32 THEN I = 42: GOTO 960
950 N$ = N$ + A$
960  NEXT I
970 NM$(NN - 1) = N$
980  PRINT : PRINT "INSERT CATALOG DATA DISK # ";DD;" IN DRIVE"
990  PRINT : PRINT "PRESS ANY KEY WHEN YOU ARE READY ";: GET T$: PRINT
1000  HOME : VTAB (10): PRINT  SPC( 15);: INVERSE : PRINT "SEARCHING": NORMAL
1010  PRINT D$;"OPEN   LIBREC-120,L120"
1020  PRINT D$;"READ LIBREC-120,R0"
1030  INPUT RN
1040  PRINT D$
1050  IF RN = 0 THEN  PRINT "NO BOOKS ON FILE ON THIS DISK.": GOTO 1230
1060  PRINT : PRINT "THIS DISK CONTAINS ";RN;" BOOK RECORDS.": PRINT
1070  FOR I = 1 TO RN
1080  IF NN > 1 GOTO 1300
1090  PRINT D$;"READ LIBREC-120,R";I;",B94"
1100  GET NA
1110  PRINT D$;
1120  IF NA > 1 GOTO 1300
1130 AU$ = ""
1140  PRINT D$;"READ LIBREC-120,R";I;",B41"
1150  INPUT AH$: PRINT D$
1160  FOR K = 1 TO 40
1170 T$ =  MID$ (AH$,K,1)
1180  IF  ASC (T$) = 32 THEN K = 40: GOTO 1200
1190 AU$ = AU$ + T$
1200  NEXT K
1210  IF AU$ = NM$(NN - 1) THEN HI = 1: NORMAL : GOSUB 2330: IF MOD <  > 1
      THEN  PRINT "CONTINUE SEARCH (Y/N)? ";: GET X$: PRINT X$: IF X$ = "N"
      THEN 270
1220  NEXT I
1230 DD = DD + 1
1240  IF DD > DN THEN  NORMAL : GOTO 770
1250  PRINT D$
1260  GOTO 980
1270  IF HI = 1 THEN 280
1280  GOSUB 3720
1290  GOTO 280
1300 AN = 1:AU$ = "": FOR P = 0 TO 4:AM$(P) = "": NEXT P
1310  PRINT D$;"READ LIBREC-120,R";I;",B41": INPUT AH$: PRINT D$
1320  FOR K = 1 TO 40
1330 A$ =  MID$ (AH$,K,1)
1340  IF  ASC (A$) = 47 THEN AN = AN + 1:AM$(AN - 2) = AU$:AU$ = "": GOTO 1370
1350  IF  ASC (A$) = 32 THEN K = 40: GOTO 1370
1360 AU$ = AU$ + A$
1370  NEXT K
1380 AM$(AN - 1) = AU$
1390 H0 = 0
1400  FOR L = 0 TO NN - 1
1410  FOR M = 0 TO AN - 1
1420  IF NM$(L) = AM$(M) THEN H0 = H0 + 1
1430  NEXT M
1440  NEXT L
1450  IF H0 = NN THEN HI = 1: NORMAL : GOSUB 2330: IF MOD <  > 1 THEN  PRINT
     "CONTINUE SEARCH (Y/N)? ";: GET X$: PRINT X$: IF X$ = "N" THEN 270
1460  GOTO 1220
1470  REM   ***** SEARCH ON SUBJECT
1480  IF  PEEK (772) = 25 THEN 1610
1490  HOME : VTAB (5)
1500  PRINT : PRINT "THE SEARCH ON SUBJECT IS CONDUCTED VIA": PRINT "THE
     DEWEY DECIMAL SYSTEM FOR NON-FICTIONBOOKS, AND BOOK TYPE FOR FICTION
      OOKS."
1510  PRINT
1520  PRINT "NON-FICTION BOOKS IN THE DEWEY DECIMAL": PRINT "SYSTEM ARE CA
     TALOGED IN 1000"
1530  PRINT "CATEGORIES: 10 DIVISIONS;": PRINT  SPC( 12);"10 CATEGORIES/DI
     VISION;": PRINT  SPC( 12);"10 SUBCATEGORIES/CATEGORY"
1540  FOR I = 1 TO 4000: NEXT I
1550  PRINT : PRINT "THE SEARCH CAN BE PERFORMED ON THE": PRINT "DIVISION,
     CATEGORY, OR SUBCATEGORY": PRINT "LEVEL."
1560  PRINT : PRINT "THE PROGRAM WILL PROMPT YOU WITH THE": PRINT "DEWEY
     DECIMAL SYSTEM BREAKDOWN OF": PRINT "SUBJECTS."
```

```
1570  PRINT : PRINT : PRINT "FICTION BOOKS IN THIS PROGRAM ARE": PRINT "CA
     TALOGED IN THE FOLLOWING DIVISIONS:"
1580  PRINT  SPC( 12);"NOVEL": PRINT  SPC( 12);"ACTION/MYSTERY": PRINT  SPC(
     12);"WESTERN": PRINT  SPC( 12);"SCIENCE FICTION": PRINT  SPC( 12);"SH
     ORT STORY/COLLECTION": PRINT  SPC( 12);"CHILDREN'S LITERATURE"
1590  FOR I = 1 TO 6000: NEXT I
1600  POKE 772,25
1610  HOME : VTAB (5): INVERSE : PRINT "IS YOUR SELECTION": NORMAL
1620  INVERSE : PRINT "FICTION OR NON-FICTION (F/N)?";: NORMAL : PRINT " "
     ;: GET TP$
1630  PRINT TP$
1640  IF TP$ = "F" GOTO 2060
1650  IF TP$ <  > "N" THEN  PRINT : GOTO 1620
1660  HOME
1670  VTAB (3): PRINT  SPC( 15);"DIVISIONS": PRINT : PRINT
1680  FOR I = 0 TO 9
1690  PRINT I;"  ";SC$(I,1)
1700  NEXT I
1710  PRINT
1720  PRINT "ENTER DIVISION NUMBER ";: GET T$
1730  PRINT T$
1740  IF  ASC (T$) < 48 OR  ASC (T$) > 57 THEN  PRINT : GOTO 1660
1750 DV =  VAL (T$)
1760  PRINT : PRINT "DO YOU WISH TO NARROW THE SUBJECT (Y/N)?": PRINT  SPC(
     15);: GET T$: PRINT T$
1770  IF T$ = "Y" THEN 1800
1780  IF T$ <  > "N" GOTO 1760
1790 SP = 100:CC = DV * 100: GOSUB 2530: GOTO 280
1800  HOME : VTAB (3)
1810  PRINT "DIVISION: ";SC$(DV,1)
1820  PRINT
1830  FOR I = 0 TO 9
1840  PRINT I;"  ";SC$(DV,(I * 10) + 1)
1850  NEXT I
1860  PRINT : PRINT
1870  PRINT "ENTER CATEGORY NUMBER"; SPC( 25);"OR 'X' FOR DIVISION LISTING
     ";: GET C$
1880  PRINT C$
1890  IF C$ = "X" GOTO 1660
1900  IF  ASC (C$) < 48 OR  ASC (C$) > 57 THEN  PRINT : GOTO 1870
1910  PRINT : PRINT "DO YOU WISH TO NARROW THE SUBJECT (Y/N)?": PRINT  SPC(
     15);: GET T$: PRINT T$
1920  IF T$ = "Y" THEN 1950
1930  IF T$ <  > "N" GOTO 1910
1940 SP = 10:CC = DV * 100 +  VAL (C$) * 10: GOSUB 2530: GOTO 280
1950  HOME : VTAB (3): PRINT "CATEGORY: ";SC$(DV,( VAL (C$) * 10) + 1)
1960  PRINT
1970  FOR I = 1 TO 10: PRINT I - 1; SPC( 2);SC$(DV,10 *  VAL (C$) + I): NEXT I
1980  PRINT
1990  PRINT "ENTER SUBCATEGORY NUMBER"; SPC( 25);"OR 'X' FOR CATEGORY LIST
     ING ";: GET S$: PRINT S$
2000  PRINT
2010  IF S$ = "X" GOTO 1800
2020  IF  ASC (S$) < 48 OR  ASC (S$) > 57 THEN 1990
2030 S$ =  STR$ ( VAL (S$) + 1)
2040 CC = DV * 100 +  VAL (C$) * 10 +  VAL (S$) - 1
2050 SP = 1: GOSUB 2530: GOTO 280
2060  HOME : VTAB (5)
2070  PRINT "FICTION"
2080  PRINT : PRINT
2090  FOR I = 1 TO 6
2100  PRINT I; SPC( 2);F$(I)
2110  NEXT I
2120  PRINT : PRINT
2130  PRINT "ENTER CATEGORY NUMBER: ";: GET T$
2140  IF  ASC (T$) < 49 OR  ASC (T$) > 54 THEN  PRINT : GOTO 2060
2150 FC =  VAL (T$)
2160 CC = FC * 100
2170 SP = 1
2180  GOSUB 2530: GOTO 280
2190  REM   *****SEARCH ON CATALOG NUMBER
2200  HOME : VTAB (5)
2210  INPUT "ENTER CATALOG NUMBER   ";CC$
2220 CC =  INT ( VAL (CC$))
2230  IF CC < 0 OR CC > 999 THEN  PRINT "INVALID CATALOG NUMBER.": PRINT "
     PLEASE TRY AGAIN.": GOTO 2210
2240 TP$ = "N"
2250 SP = 1: GOSUB 2530: GOTO 280
2260  PRINT D$;"CLOSE LIBREC-120": REM  END SEARCH - RETURN TO CATALOG
     MASTER
2270  HOME : VTAB (5)
2280  PRINT "PLACE CATALOG MASTER DISK IN DRIVE"
2290  PRINT : PRINT "PRESS ANY KEY WHEN YOU ARE READY ";: GET T$: PRINT
2300  HIMEM: 38400
2310  PRINT D$;"RUN CATALOG MASTER"
2320  REM  ******* SUBROUTINE TO WRITE DATA TO SCREEN *********
2330  PRINT D$
2340  PRINT D$;"READ LIBREC-120,R";I
2350  INPUT TL$: INPUT AU$: INPUT TP$: INPUT CN$: INPUT LC$: INPUT SZ$:
     INPUT NA
2360  INPUT BS: INPUT BN$
```

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CIRCLE 252 ON READER SERVICE CARD

Library Catalog, continued...

```
2370  PRINT D$
2380 CN =  VAL (CN$)
2390  PRINT : PRINT BR$
2400  PRINT "TITLE: ";TL$: PRINT "AUTHOR: ";AU$: PRINT "LOCATION: ";LC$: PRINT
     "SIZE (SMALL-NORMAL-TALL): ";SZ$: PRINT "CATEGORY: ";: IF TP$ = "F" THEN
      PRINT "FICTION": GOTO 2420
2410  PRINT "NON-FICTION": PRINT "CATALOG NUMBER: ";CN$: GOTO 2490
2420  PRINT "FICTION TYPE: ";
2430  IF CN$ = "100" THEN  PRINT "NOVEL": GOTO 2490
2440  IF CN$ = "200" THEN  PRINT "ACTION/MYSTERY": GOTO 2490
2450  IF CN$ = "300" THEN  PRINT "WESTERN": GOTO 2490
2460  IF CN$ = "400" THEN  PRINT "SCIENCE FICTION": GOTO 2490
2470  IF CN$ = "500" THEN  PRINT "SHORT STORY/COLLECTION": GOTO 2490
2480  PRINT "CHILDREN'S LITERATURE"
2490  IF BS = 0 THEN  PRINT "BOOK HAS NOT BEEN LOANED OUT.": GOTO 2510
2500  PRINT "BOOK IS LOANED TO: ";BN$
2510  PRINT
2520  RETURN
2530  REM    ******SUBROUTINE TO SEARCH ON CATALOG NUMBER
2540  HOME : VTAB (5):DD = 1:HI = 0
2550  PRINT "INSERT CATALOG DATA DISK # ";DD;" IN DRIVE"
2560  PRINT : PRINT "PRESS ANY KEY WHEN YOU ARE READY."
2570  GET T$: PRINT
2580  HOME : VTAB (10)
2590  PRINT  SPC( 15);: INVERSE : PRINT "SEARCHING": NORMAL
2600  PRINT D$;"OPEN LIBREC-120,L120"
2610  PRINT D$;"READ LIBREC-120,R0"
2620  INPUT RN
2630  PRINT D$
2640  IF RN = 0 THEN  PRINT "NO BOOKS ON FILE ON THIS DISK.": GOTO 2760
2650  PRINT : PRINT "THIS DISK CONTAINS ";RN;" BOOK RECORDS.": PRINT
2660  FOR I = 1 TO RN
2670  PRINT D$;"READ LIBREC-120,R";I;",B82"
2680  INPUT PP$
2690  PRINT D$
2700  IF TP$ <  > PP$ THEN  GOTO 2740
2710  PRINT D$;"READ LIBREC-120,R";I;",B84"
2720  INPUT CN$:CN =  VAL (CN$)
2730  IF  INT (CN / SP) * SP = CC THEN HI = 1: GOSUB 2330: IF MOD <  > 1 THEN
      PRINT "CONTINUE SEARCH (Y/N)? ";: GET X$: PRINT X$: IF X$ = "N" THEN
      POP : GOTO 270
2740  NEXT I
2750  PRINT D$
2760 DD = DD + 1
2770  IF DD > DN THEN  GOTO 2800
2780  PRINT D$
2790  GOTO 2550
2800  IF HI = 1 THEN  PRINT D$: PRINT : PRINT "THIS IS THE END OF THIS SEA
     RCH.": PRINT "PRESS ANY KEY TO CONTINUE. ": GET KK$: PRINT : RETURN
2810  GOSUB 3720
2820  RETURN
2830  REM    ******* SUBROUTINE TO MODIFY A RECORD
2840  PRINT : PRINT : PRINT "DO YOU WANT TO CHECK IN/OUT": PRINT  SPC( 15)
     ;"THIS BOOK (Y/N): ";: GET T$: PRINT T$
2850  IF T$ = "N" THEN 2900
2860  IF T$ <  > "Y" THEN 2840
2870  IF BS = 0 THEN BS = 1: PRINT : INPUT "ENTER BORROWER'S LAST NAME: ";
     LN$: INPUT "ENTER BORROWER'S FIRST NAME: ";FM$:BN$ =  LEFT$ ((LN$ + "
     /" + FM$ + BL$),15): GOTO 3470
2880 BS = 0:BN$ =  LEFT$ (BL$,15)
2890  PRINT : PRINT "BOOK IS NOW CHECKED IN.": PRINT "SHELVE AT LOCATION "
     ;LC$: GOTO 3470
2900  HOME : VTAB (5)
2910  PRINT "CURRENT TITLE: ";TL$
2920  PRINT "CHANGE ENTRY (Y/N)? ";: GET M$: PRINT M$
2930  IF M$ <  > "Y" THEN 2950
2940  INPUT "ENTER NEW TITLE: ";TL$
2950  PRINT : PRINT "CURRENT AUTHOR: ";AU$
2960  PRINT "CHANGE ENTRY (Y/N)? ";: GET M$: PRINT M$
2970  IF M$ <  > "Y" THEN 3050
2980  PRINT : PRINT "ENTER NEW AUTHOR(S)"
2990  PRINT "LAST (/LAST/...) NAME(S)"
3000  PRINT "NO COMMAS OR SPACES, PLEASE!!"
3010  INPUT "    ";AU$
3020 NA = 1
3030  FOR P = 1 TO  LEN (AU$): IF  ASC ( MID$ (AU$,P,1)) = 47 THEN NA =
     NA + 1
3040  NEXT P
3050  PRINT : PRINT "CURRENT TYPE (F=FICT; N=NON-FICT): ";TP$
3060  PRINT "CHANGE ENTRY (Y/N)? ";: GET M$: PRINT M$
3070  IF M$ <  > "Y" THEN 3100
3080  IF TP$ = "F" THEN TP$ = "N": GOTO 3100
3090 TP$ = "F"
3100  PRINT : PRINT "CURRENT CATALOG NUMBER: ";CN$
3110  PRINT "CHANGE ENTRY (Y/N)? ";: GET M$: PRINT M$
3120  IF M$ <  > "Y" THEN 3190
3130  INPUT "ENTER NEW CATALOG NUMBER: ";CN$
3140 CN =  INT ( VAL (CN$))
3150  IF CN < 0 OR CN > 999 THEN  PRINT "INVALID CATALOG NUMBER.": PRINT "
     PLEASE TRY AGAIN.": GOTO 3130
3160  IF CN < 10 THEN CN$ = "00" +  STR$ (CN): GOTO 3190
```

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CIRCLE 259 ON READER SERVICE CARD

Library Catalog, continued...

The remainder of this article is devoted to the technical details of the program and need not be read if you have no desire to do anything but use your computer to keep track of your books. However, before you rush to your keyboard, please read the following few notes of importance.

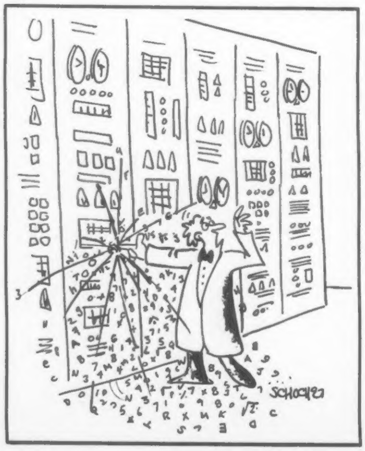
The program consists of a series of routines that are called from a Catalog Master routine. Additional routines are Catalog Enter, Catalog Search, Catalog Borrow, Catalog Bookshelf, and Catalog List. All of these routines should be stored on a single Catalog Master disk which will also contain files with the catalog classification data and information on bookshelf location and sizes. The length of the routines forces this type of structure. A benefit of this breakdown is the added ease of debugging each routine separately. The book data are stored on separate disks.

A series of ten programs with titles of the form SC PROGRAM 3 is used to create text files with the library classification data needed to derive the specific catalog number for each book. Once these programs have been used to create these files, they can be DELETEd from your Catalog Master disk. These ten programs must be run prior to the first use of the Enter routine.

A few words of caution before you start typing. Since the Catalog Master disk is in active use while cataloguing it is possible to write over all or part of the routines by accident. LOCK them after they are entered and keep a backup disk. It is also a good idea to run backup disks of your book data disks periodically — just in case.

Program Structure

The structure of the Library Catalog Program is shown schematically in



```
3170  IF CN < 100 THEN CN$ = "0" +  STR$ (CN): GOTO 3190
3180 CN$ =  STR$ (CN)
3190  PRINT : PRINT "CURRENT SIZE IS": PRINT  SPC( 10);"(S-SMALL::N-NORMAL
     ::T-TALL): ";SZ$
3200  PRINT "CHANGE ENTRY (Y/N)? ";: GET M$: PRINT M$
3210  IF M$ <  > "Y" THEN 3270
3220  INPUT "ENTER SIZE (S-N-T): ";M$
3230  IF M$ = "S" THEN SZ$ = "S": GOTO 3270
3240  IF M$ = "N" THEN SZ$ = "N": GOTO 3270
3250  IF M$ = "T" THEN SZ$ = "T": GOTO 3270
3260  PRINT "INVALID SIZE. TRY AGAIN.": GOTO 3220
3270  PRINT : PRINT "CURRENT LOCATION IS: ";LC$
3280  PRINT "CHANGE ENTRY (Y/N)? ";: GET M$: PRINT M$
3290  IF M$ <  > "Y" THEN 3390
3300  PRINT "ENTER NEW LOCATION-"
3310  PRINT  SPC( 10);"(LETTER LETTER NUMBER)"
3320  INPUT "     ";M$
3330  IF  LEN (M$) <  > 3 THEN 3380
3340  IF  ASC ( LEFT$ (M$,1)) < 65 OR  ASC ( LEFT$ (M$,1)) > 90 GOTO 3380
3350  IF  ASC ( MID$ (M$,2,1)) < 65 OR  ASC ( MID$ (M$,2,1)) > 90 GOTO 3380
3360  IF  ASC ( RIGHT$ (M$,1)) < 48 OR  ASC ( RIGHT$ (M$,1)) > 57 GOTO 3380
3370 LC$ = M$: GOTO 3390
3380  PRINT "INVALID LOCATION. TRY AGAIN. ": GOTO 3300
3390  PRINT : PRINT "ANY CHANGES (Y/N)? ";
3400  GET M$: PRINT M$
3410  IF M$ <  > "Y" GOTO 3430
3420  GOTO 2900
3430  IF  LEN (TL$) < 40 THEN TL$ = TL$ +  LEFT$ (BL$,40 -  LEN (TL$))
3440 TL$ =  LEFT$ (TL$,40)
3450  IF  LEN (AU$) < 40 THEN AU$ = AU$ +  LEFT$ (BL$,40 -  LEN (AU$))
3460 AU$ =  LEFT$ (AU$,40)
3470  PRINT D$;"OPEN LIBREC-120,L120"
3480  PRINT D$;"WRITE LIBREC-120,R";I
3490  PRINT TL$: PRINT AU$: PRINT TP$: PRINT CN$: PRINT LC$: PRINT SZ$: PRINT NA
3500  PRINT BS: PRINT BN$
3510  PRINT D$
3520  PRINT : PRINT "DO YOU WISH TO MODIFY OTHER ENTRIES": PRINT "WITH THE
      SAME TITLE (Y/N)? ";: GET M$: PRINT M$
3530  IF M$ = "Y" THEN  GOTO 710
3540  PRINT : PRINT "THIS IS THE END OF THIS SEARCH.": PRINT "DO YOU WISH
     TO": PRINT "MODIFY OTHER ENTRIES (Y/N)? ";: GET M$: PRINT M$
3550  IF M$ <  > "Y" THEN 2260
3560  GOTO 400
3570  REM   ****** SUBROUTINE TO DELETE A RECORD
3580  IF I = RN THEN 3650
3590  PRINT D$;"READ LIBREC-120,R";RN
3600  INPUT TL$: INPUT AU$: INPUT TP$: INPUT CN$: INPUT LC$: INPUT SZ$: INPUT
     NA: INPUT BS: INPUT BN$
3610  PRINT D$
3620  PRINT D$;"WRITE LIBREC-120,R";I
3630  PRINT TL$: PRINT AU$: PRINT TP$: PRINT CN$: PRINT LC$: PRINT SZ$: PRINT
     NA: PRINT BS: PRINT BN$
3640  PRINT D$
3650 RN = RN - 1
3660  PRINT D$
3670  PRINT D$;"WRITE LIBREC-120,R0"
3680  PRINT RN
3690  PRINT D$
3700  IF RN = 0 THEN  INVERSE : PRINT "THIS  DISK NO LONGER CONTAINS": PRINT
     "CATALOG DATA": NORMAL : FOR Y = 1 TO 2000: NEXT Y
3710  GOTO 3520
3720  PRINT D$
3730  PRINT : PRINT
3740  PRINT : PRINT "NO RECORDS HAVE BEEN FOUND.": PRINT "PRESS ANY KEY TO
      CONTINUE.";: GET T$: PRINT
3750  IF MOD = 1 THEN  POP : GOTO 3540
3760  RETURN
3770  REM  ERROR ROUTINE
3780  IF  PEEK (222) <  > 5 THEN  PRINT "ERROR FOUND CODE "; PEEK (222);"
     ON LINE "; PEEK (218) +  PEEK (219) * 256: END
3790  PRINT D$;"OPEN LIBREC-120,L120"
3800  PRINT D$;"WRITE LIBREC-120,R0"
3810 ZZ = 0
3820  PRINT ZZ
3830  PRINT D$;"CLOSE"
3840  IF CH = 2 GOTO 1010
3850  IF CH = 1 GOTO 500
3860  GOTO 2600
```

Listing 4.

```
10  REM  CATALOG LIST PROGRAM
20 D$ =  CHR$ (4)
30  ONERR  GOTO 350
40 DD = 1
50 DN =  PEEK (771)
60  POKE 770,56
70 SP$ = "- - - - - - - - - - - - - - - - - - - -"
```

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Library Catalog, continued...

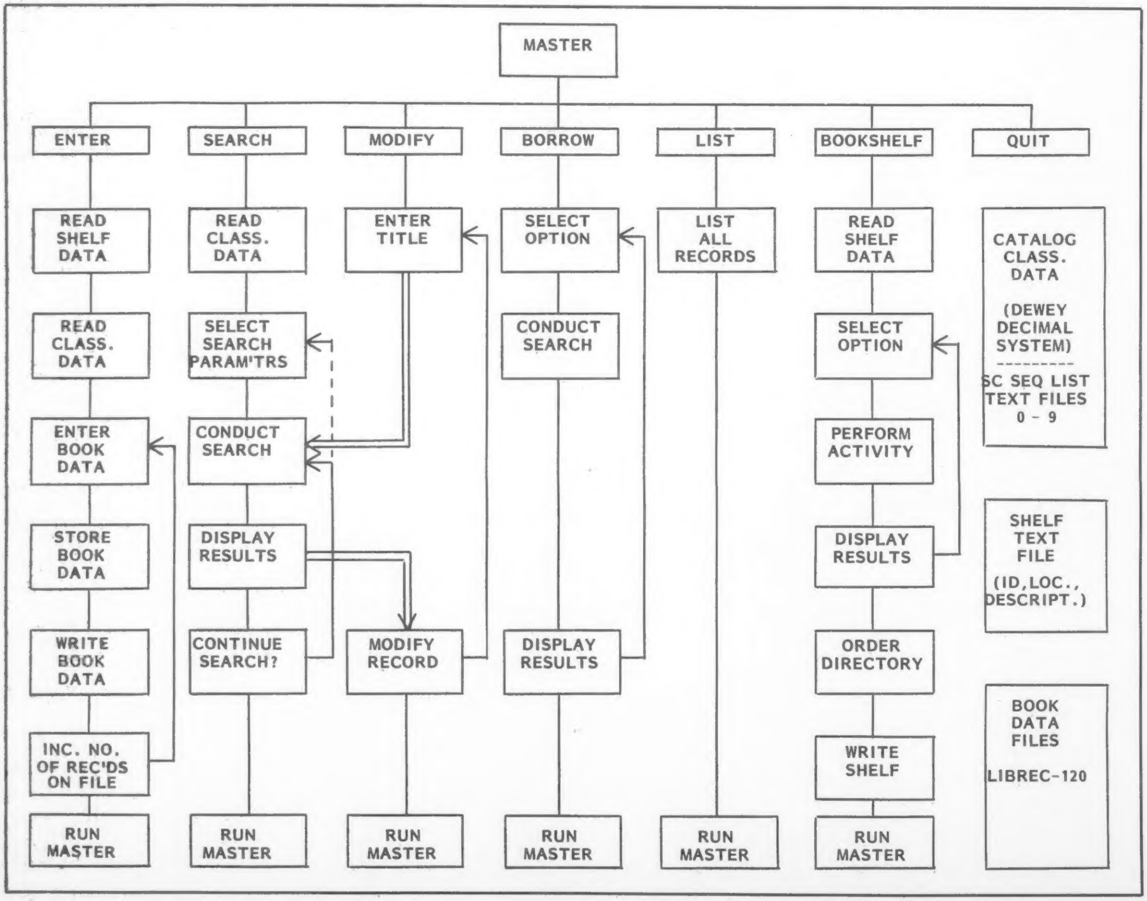
Figure 7. The primary menu is contained in Master, and selection from this menu runs the other routines. Information that needs to be transmitted from one program routine to another is done via POKEing the data into memory locations in one routine and PEEKing into these locations to recover it in the next routine.

The catalog classification and bookshelf identification are called as required by the Enter, Search, and Bookshelf routines. When each of the functional routines is exited, Master is run automatically and the primary menu is displayed once again. This type of structure, where only the specific routine that is needed is in memory makes it possible to run on a 48K machine programs that would otherwise require a much larger memory.

Book data are stored in random access files (named LIBREC-120) on disks separate from the Catalog Master disk. Record length for this file

```
80  HOME : VTAB (5)
90  PRINT "LISTING OF ALL BOOKS IN CATALOG": PRINT
100  PRINT "INSERT CATALOG DATA DISK # ";DD;" IN DRIVE"
110  PRINT "PRESS ANY KEY WHEN YOU ARE READY ";: GET T$: PRINT
120  PRINT
130  PRINT D$;"OPEN LIBREC-120,L120"
140  PRINT D$;"READ LIBREC-120,R0"
150  INPUT RN
160  PRINT D$
170  IF RN = 0 THEN  PRINT "NO BOOKS ON FILE ON THIS DISK.": GOTO 270
180  PRINT : PRINT "THIS DISK CONTAINS ";RN;" BOOK RECORDS.": PRINT
190  HIMEM: 20000
200  FOR I = 1 TO RN
210  PRINT D$;"READ LIBREC-120,R";I;",B0"
220  INPUT TL$: INPUT AU$
230  PRINT D$
240  PRINT SP$: PRINT "TITLE: ";TL$: PRINT "AUTHOR: ";AU$
250  FOR K = 1 TO 500: NEXT K
260  NEXT I
270 DD = DD + 1
280  IF DD > DN THEN 300
290  GOTO 100
300  PRINT : PRINT "ALL BOOKS HAVE BEEN LISTED"
310  PRINT : PRINT "RETURN CATALOG MASTER DISK TO THE DRIVE"
320  PRINT "PRESS ANY KEY WHEN YOU ARE READY.";: GET T$: PRINT
330  HIMEM: 38400
340  PRINT D$;"RUN CATALOG MASTER"
350  REM  ERROR ROUTINE
360  IF  PEEK (222) <  > 5 THEN  PRINT "ERROR FOUND CODE "; PEEK (222): END
370  PRINT D$;"OPEN LIBREC-120,L120"
380  PRINT D$;"WRITE LIBREC-120,R0"
390 ZZ = 0
400  PRINT ZZ
410  PRINT D$;"CLOSE"
420  GOTO 130
```

Figure 7. Structure of Library Catalog Program.


MASTER
ENTER
SEARCH
MODIFY
BORROW
LIST
BOOKSHELF
QUIT
READ SHELF DATA
READ CLASS. DATA
ENTER BOOK DATA
STORE BOOK DATA
WRITE BOOK DATA
INC. NO. OF REC'DS ON FILE
RUN MASTER
READ CLASS. DATA
SELECT SEARCH PARAM'TRS
CONDUCT SEARCH
DISPLAY RESULTS
CONTINUE SEARCH?
RUN MASTER
ENTER TITLE
MODIFY RECORD
RUN MASTER
SELECT OPTION
CONDUCT SEARCH
DISPLAY RESULTS
RUN MASTER
LIST ALL RECORDS
RUN MASTER
READ SHELF DATA
SELECT OPTION
PERFORM ACTIVITY
DISPLAY RESULTS
ORDER DIRECTORY
WRITE SHELF
RUN MASTER
CATALOG CLASS. DATA
(DEWEY DECIMAL SYSTEM)
SC SEQ LIST TEXT FILES 0 - 9
SHELF TEXT FILE
(ID,LOC., DESCRIPT.)
BOOK DATA FILES
LIBREC-120

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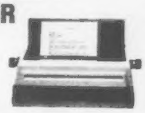

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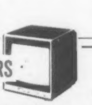

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is 120 bytes. Information on shelf identification numbers, sizes, and location descriptions is stored on the Catalog Master disk in a sequential text file named SHELF.

What The Routines Do

Catalog Master (Listing 1) is the traffic director for the Library Catalog Program. When the program is run, memory location 770 is examined. If the value stored is anything but 56, a number which I selected randomly, the descriptive information on lines 50 to 260 is presented on the screen. On later occasions, when this routine is called from the other routines in the program, the value 56 will have been POKEd into this location and the introduction will not be printed. This random number was selected so that there is only a small probability that the introduction will be skipped if the Catalog program is run after some other program which utilizes this memory location.

The remainder of the routine formulates the menu which is used to call the Enter, Search, and other routines for the actual work. If the decision is made to modify a record, the value 92 is POKEd into 773 to tell the Search routine that it is to be used in its modify mode.

When the selection of the desired operation is made, the Catalog Master program goes to the appropriate statement and runs the necessary routine.

Catalog Enter

Catalog Enter (Listing 2) is the routine that requests data on books to be added to the catalog, provides an opportunity to revise the data, checks to make sure that the data are within the expected range, formats the data as required for storage, and prints the data to the disk. For nonfiction books the determination of catalog number for each entry is provided by selection from an ever narrowing listing of subject areas. Provision is made for returning to a broader description of the subject if an error is made in the original selection.

The listing of the catalog descriptors is stored in the array SC$, which has 1000 elements. During the initial access to the Enter program, this array is filled from ten sequential text files stored on the Catalog Master disk. This read-in process takes about a minute and a half, during which descriptive material is on the screen. Once this data are read in, the Master disk is removed and replaced with the disk to be used for the storage of data.

The data are stored in the file named

Listing 5.

```
1  REM  THIS PROGRAM IS COPYRIGHT 1982 BY J.M. HELLMAN : 336 COLEMAN DRIVE
     : MONROEVILLE PA 15146 : PHONE 412-372-9004
10  REM  CATALOG BORROW PROGRAM
20  HIMEM: 20000
30  POKE 770,56
40 DN =  PEEK (771)
50 D$ =  CHR$ (4)
60 SP$ = "- - - - - - - - - - - - - - - - - - - - -"
70 BL$ = "                 "
80 DD = 1
90  ONERR  GOTO 910
100  HOME : VTAB (5):ST = 0
110 DD = 1
120  PRINT "DO YOU WISH TO LIST"
130  PRINT  SPC( 5);"(1)  ALL BOOKS LOANED OUT"
140  PRINT  SPC( 5);"(2)  BOOKS LOANED TO A GIVEN PERSON"
150  PRINT "  OR (3)  END THE SEARCH"
160  PRINT : PRINT "ENTER THE NUMBER OF YOUR SELECTION ";: GET T$: PRINT :
     PRINT
170  IF T$ = "1" THEN 210
180  IF T$ = "2" THEN 430
190  IF T$ = "3" THEN  HOME : VTAB (4): GOTO 850
200  GOTO 100
210  REM  ROUTINE TO LIST ALL BOOKS LOANED OUT
220  REM  SEARCH IS ON BYTE 96
230  HOME : VTAB (5):HI = 0:ST = 1
240  PRINT "INSERT CATALOG DATA DISK # ";DD;" IN DRIVE"
250  PRINT : PRINT "PRESS ANY KEY WHEN YOU ARE READY ";: GET T$: PRINT : PRINT
260  HOME : VTAB (5)
270  PRINT "LISTING OF ALL BOOKS OUT ON LOAN": PRINT
280  PRINT D$;"OPEN LIBREC-120,L120"
290  PRINT D$;"READ LIBREC-120,R0"
300  INPUT RN
310  PRINT D$
320  IF RN = 0 THEN  PRINT "NO BOOKS ON FILE ON THIS DISK": FOR Q = 1 TO 4000
    : NEXT Q: GOTO 400
330  PRINT : PRINT "THIS DISK CONTAINS ";RN;" BOOK RECORDS.": PRINT
340  FOR I = 1 TO RN
350  PRINT D$;"READ LIBREC-120,R";I;",B96"
360  INPUT BS
370  PRINT D$
380  IF BS = 1 THEN HI = 1: GOSUB 700
390  NEXT I
400 DD = DD + 1
410  IF DD > DN THEN  GOTO 810
420  GOTO 240
430  REM  SUBROUTINE TO FIND BOOKS LOANED TO A GIVEN PERSON
440  HOME : VTAB (5)
450  INPUT "ENTER BORROWER'S LAST NAME: ";LN$
460  INPUT "ENTER BORROWER'S FIRST NAME: ";FM$
470 BB$ =  LEFT$ ((LN$ + "/" + FM$ + BL$),15)
480 HI = 0:DD = 1
490  HOME : VTAB (5): PRINT "LISTING OF BOOKS": PRINT  SPC( 5);"BORROWED BY:
    ";BB$
500  PRINT
510  PRINT "INSERT CATALOG DATA DISK # ";DD;" IN DRIVE."
520  PRINT : PRINT "PRESS ANY KEY WHEN YOU ARE READY. ";: GET T$: PRINT : PRINT
530  PRINT D$;"OPEN LIBREC-120,L120"
540  PRINT D$;"READ LIBREC-120,R0"
550  INPUT RN
560  PRINT D$
570  IF RN = 0 THEN  PRINT "NO BOOKS ON FILE IN THIS DISK.": GOTO 670
580  FOR I = 1 TO RN
590  PRINT D$;"READ LIBREC-120,R";I;",B96"
600  INPUT BS
610  PRINT D$
620  IF BS = 0 THEN 660
630  PRINT D$;"READ LIBREC-120,R";I;",B98"
640  INPUT BN$
650  IF BN$ = BB$ THEN HI = 1: GOSUB 700
660  NEXT I
670 DD = DD + 1
680  IF DD > DN THEN 810
690  GOTO 510
700  REM  SUBROUTINE TO PRINT BOOK DATA
710  PRINT D$;"READ LIBREC-120,R";I;",B0"
720  INPUT TL$: INPUT AU$
730  IF ST = 2 GOTO 760
740  PRINT D$;"READ LIBREC-120,R";I;",B98"
750  INPUT BN$
760  PRINT D$
770  PRINT : PRINT SP$
780  PRINT "TITLE: ";TL$: PRINT "AUTHOR: ";AU$: IF ST = 1 THEN  PRINT "BOR
     ROWER: ";BN$
790  PRINT : PRINT "   CONTINUE SEARCH (Y/N)? ";: GET T$: PRINT : IF T$ =
     "N" THEN  POP : GOTO 100
800  RETURN
810  IF HI = 1 THEN 890
```

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CIRCLE 231 ON READER SERVICE CARD

LIBREC-120. Details of the file format are given below. The Enter routine opens the file and reads the first record, which contains the number of books currently stored on the disk. If no books are on the disk, the error routine is used to place a zero in the necessary location, and the processing continues. The screen then requests title, author, location, book height (remember, some of my bookshelves are suitable only for small books, and others will accommodate oversize books), and whether the book is fiction or nonfiction.

The title and author are allocated 40 characters each in the data file. The title can contain any characters except the comma or quotation mark. No commas, quotation marks, or spaces are permitted in the author list. Multiple author names are separated with slashes (/), giving the Search program a key to find each name individually.

If the book is fiction, the program jumps to a series of steps that generate the menu for selection of the fiction type, e.g., novel, western, science-fiction, etc. If the book is nonfiction, the primary menu for subject classification is presented, showing the 10 divisions. Upon selection from this menu the appropriate 10 categories for the division are shown, and following selection from this menu, the appropriate 10 subcategories are shown and a selection is made. The routine automatically inserts in the data file the information that the book is not out on loan. The routine also computes the number of authors based on the input. This information is used in the Search routine.

During data entry, each entry you type in is verified to be within the expected range. No protection can be given against spelling errors in the title or author entries, but, for example, the size entry must be either S, N, or T, and the location must be a letter, letter, number sequence for the entry to be accepted. After all necessary data are entered, a listing is presented of the total record, and an opportunity is presented to change incorrect entries. If all are correct, the data are stored in the arrays reserved for them. The operator then has the choice of continuing to add books or to end data entry.

The location of the book must be specified at the time it is entered into the catalog. When the three-character shelf ID is entered, the Enter routine checks that the ID is in the correct format, that the ID has been entered (in the Bookshelf routine) as an existing shelf, and for an inconsistency in

```
820  HOME : VTAB (5)
830  PRINT "NO BOOKS ARE OUT ON LOAN"
840  PRINT : PRINT "PRESS ANY KEY TO CONTINUE ";: GET T$: PRINT : PRINT : GOTO 100
850  PRINT : PRINT "RETURN THE CATALOG MASTER DISK": PRINT  SPC( 5);"TO THE DRIVE"
860  PRINT "PRESS ANY KEY WHEN YOU ARE READY ";: GET T$: PRINT : PRINT
870  HIMEM: 38400
880  PRINT D$;"RUN CATALOG MASTER"
890  PRINT : PRINT SP$: PRINT "ALL BOOKS ON LOAN HAVE BEEN FOUND"
900  GOTO 840
910  REM  ERROR SUBROUTNIE
920  IF  PEEK (222) <  > 5 THEN  PRINT "ERROR FOUND CODE "; PEEK (222): POKE
     216,0: END
930  PRINT "NO BOOK RECORDS FOUND ON THIS DISK": FOR K = 1 TO 2000: NEXT K
940  IF ST = 1 GOTO 400
950  GOTO 670
```

Listing 6.

```
1  REM  THIS PROGRAM IS COPYRIGHT 1982 BY J.M. HELLMAN : 336 COLEMAN DRIVE
     : MONROEVILLE PA 15146 : PHONE 412-372-9004
10  REM  CATALOG BOOKSHELF PROGRAM
20  POKE 770,56
30 BR$ = "- - - - - - - - - - - - - - - - - - - - - "
40  HOME : VTAB (5)
50  PRINT  SPC( 4);: INVERSE : PRINT "BOOKSHELF IDENTIFICATION PROGRAM": NORMAL
60 N = 200
70  DIM LC$(N,1),DC$(N)
80 D$ =  CHR$ (4)
90  ONERR  GOTO 1210
100  PRINT D$;"OPEN SHELF"
110  PRINT D$;"READ SHELF"
120  INPUT NS
130  PRINT D$
140  IF NS = 0 THEN  PRINT : PRINT "NO SHELF DATA IS NOW ON FILE.": PRINT
     : GOTO 200
150  PRINT D$;"READ SHELF"
160  FOR I = 1 TO NS: INPUT LC$(I,0): INPUT LC$(I,1): NEXT I
170  FOR I = 1 TO NS: INPUT DC$(I): NEXT I
180  PRINT D$
190  PRINT
200  PRINT "DO YOU WISH TO": PRINT
210  PRINT  SPC( 5);"(1)  ADD SHELVES TO THE LIBRARY": PRINT
220  PRINT  SPC( 5);"(2)  REMOVE SHELVES FROM LIBRARY": PRINT
230  PRINT  SPC( 5);"(3)  GET A SHELF DIRECTORY": PRINT
240  PRINT  SPC( 5);"(4)  END SHELF OPERATIONS"
250  PRINT : PRINT "ENTER THE NUMBER OF YOUR SELECTION ";: GET T$:
    PRINT T$
260  IF T$ = "1" THEN 310
270  IF T$ = "2" THEN 600
280  IF T$ = "3" THEN 790
290  IF T$ = "4" THEN 1120
300  GOTO 250
310  HOME : VTAB (5)
320  PRINT "NOTE: EACH SHELF IN A BOOKSHELF MUST"
330  PRINT "BE ADDED INDIVIDUALLY"
340  PRINT : PRINT "TO CORRECT ERRORS-": PRINT "REMOVE THE SHELF FROM THE
     FILE": PRINT "AND REENTER IT": PRINT
350  PRINT : PRINT BR$: PRINT "ENTER THE ID NUMBER OF THE NEW"
360  INPUT "SHELF (LETTER LETTER NO. EG JH2) ";LC$
370  IF  LEN (LC$) <  > 3 THEN 360
380  IF  ASC ( LEFT$ (LC$,1)) < 65 OR  ASC ( LEFT$ (LC$,1)) > 90 THEN 360
390  IF  ASC ( MID$ (LC$,2,1)) < 65 OR  ASC ( MID$ (LC$,2,1)) > 90 THEN 360
400  IF  ASC ( RIGHT$ (LC$,1)) < 48 OR  ASC ( RIGHT$ (LC$,1)) > 57 THEN 360
410 HH = 0
420  IF NS = 0 THEN 460
430  FOR I = 1 TO NS: IF LC$(I,0) = LC$ THEN HH = 1:I = NS + 1
440  NEXT I
450  IF HH = 1 THEN  PRINT : PRINT "THE SHELF NUMBER YOU ENTERED HAS": PRINT
     "ALREADY BEEN ASSIGNED. PLEASE TRY AGAIN.": GOTO 350
460  PRINT : PRINT "ENTER LARGEST HEIGHT BOOK THE SHELF"
470  PRINT "WILL ACCEPT (S-SMALL/N-NORMAL/T-TALL) ";: GET SZ$: PRINT SZ$
480  IF SZ$ = "S" THEN 520
490  IF SZ$ = "N" THEN 520
500  IF SZ$ = "T" THEN 520
510  GOTO 460
520 NS = NS + 1:LC$(NS,0) = LC$:LC$(NS,1) = SZ$
530  PRINT
540  PRINT "ENTER A SHORT DESCRIPTION OF"
550  PRINT "THE SHELF LOCATION  ";: INVERSE : PRINT "NO COMMAS!": NORMAL
560  PRINT : INPUT "    ";DC$(NS)
570  PRINT : PRINT "ADD MORE SHELVES (Y/N)? ";: GET T$: PRINT T$
580  IF T$ = "Y" THEN 310
590  HOME : VTAB (5): GOTO 200
600  HOME : VTAB (5)
610  IF NS = 0 THEN  PRINT : PRINT "NO SHELF ID'S ON FILE TO REMOVE!": PRINT
     : GOTO 200
620  PRINT "NOTE: EACH SHELF IN A BOOKSHELF MUST"
630  PRINT "BE REMOVED INDIVIDUALLY."
```

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the specified book height and the height of the specified bookshelf. For example, a book of "normal" height cannot be placed on a "short" shelf. If a mismatch occurs during any of the checks the operator is given the choice of reviewing a shelf directory as an aid in correct placement of the book.

After five entries are made, or if the selection has been made to terminate data entry, a subroutine is called to write the stored data to the disk. With 48K memory, there is actually room to store a greater number of records between interruptions for disk storage, but five has been selected to minimize data loss in case of power interruption or other disaster.

After all records are entered, the number of records on the disk, stored in record 0, is increased. If during the writing process the disk becomes full, the drive door is left open after a disk switch, or if the disk has been write protected, an appropriate message is shown and the data are saved. All of the information stored in the computer memory from the books that are to be entered is then written when the drive door is closed or a new disk is inserted.

After the catalog classification data are read into the program, lines 330-390, HIMEM is set to 20000. The reason for this change is given below.

When data entry is completed instructions are given to reinsert the Catalog Master disk in the drive, and the Catalog Master routine is run.

Catalog Search

The Search routine (Listing 3) is the most complex in the program and is used to find books based on any of several keys, and also to modify the

"I picked up that thousand-item multiple regression analysis that you've been working on for two months. Here's the output."

```
640  PRINT : PRINT BR$: PRINT : PRINT "ENTER THE ID NUMBER OF THE REMOVED"
650  INPUT "SHELF (LETTER LETTER NO. EG JH2) ";LC$
660  IF  LEN (LC$) <  > 3 THEN 640
670  IF  ASC ( LEFT$ (LC$,1)) < 65 OR  ASC ( LEFT$ (LC$,1)) > 90 THEN 640
680  IF  ASC ( MID$ (LC$,2,1)) < 65 OR  ASC ( MID$ (LC$,2,1)) > 90 THEN 640
690  IF  ASC ( RIGHT$ (LC$,1)) < 48 OR  ASC ( RIGHT$ (LC$,1)) > 57 THEN 640
700 HH = 0
710  IF NS = 0 THEN  PRINT "NO SHELF ID'S ON FILE TO REMOVE!": GOTO 200
720  FOR I = 1 TO NS: IF LC$(I,0) = LC$ THEN HH = 1:LC$(I,0) = LC$(NS,0):L
     C$(I,1) = LC$(NS,1):DC$(I) = DC$(NS):I = NS + 2
730  NEXT I
740  IF HH = 0 THEN  PRINT : PRINT "THE SHELF NUMBER YOU ENTERED HAS": PRINT
     "NOT BEEN ASSIGNED. PLEASE TRY AGAIN.": GOTO 640
750 NS = NS - 1
760  PRINT : PRINT "REMOVE MORE SHELVES (Y/N)? ";: GET T$: PRINT T$
770  IF T$ = "Y" THEN 600
780  HOME : VTAB (5): GOTO 200
790  HOME : VTAB (5)
800  IF NS = 0 THEN  PRINT "NO SHELF ID'S ARE ON FILE.": PRINT : GOTO 200
810  PRINT : PRINT "DO YOU WANT A LISTING OF": PRINT
820  PRINT "      (1)  ALL BOOKSHELF ID'S AND": PRINT  SPC( 12);"LOCATIONS"

830  PRINT
840  PRINT "      (2)  A PARTICULAR SHELF"
850  PRINT
860  PRINT "OR   (3)  END DIRECTORY"
870  PRINT : PRINT "ENTER THE NUMBER OF YOUR SELECTION ";: GET T$:
    PRINT T$
880  IF T$ = "1" THEN 920
890  IF T$ = "2" THEN 990
900  IF T$ = "3" THEN  HOME : VTAB (5): GOTO 200
910  GOTO 790
920  HOME : VTAB (5)
930  FOR I = 1 TO NS
940  PRINT BR$
950  PRINT "ID  = ";LC$(I,0); SPC( 10);"SIZE= ";LC$(I,1): PRINT "LOCATION:
      ";DC$(I)
960  FOR J = 1 TO 2000: NEXT J
970  NEXT I
980  PRINT BR$: PRINT : PRINT "END OF LISTING": PRINT "PRESS ANY KEY TO CO
     NTINUE ";: GET T$: PRINT : HOME : VTAB (5): GOTO 810
990  HOME : VTAB (5)
1000  PRINT "ENTER THE ID NUMBER OF THE SHELF"
1010  PRINT "IN THE FORMAT": INPUT "      LETTER LETTER NO. EG JH2 ";LC$
1020  IF  LEN (LC$) <  > 3 THEN 990
1030  IF  ASC ( LEFT$ (LC$,1)) < 65 OR  ASC ( LEFT$ (LC$,1)) > 90 THEN 990

1040  IF  ASC ( MID$ (LC$,2,1)) < 65 OR  ASC ( MID$ (LC$,2,1)) > 90 THEN 990
1050  IF  ASC ( RIGHT$ (LC$,1)) < 48 OR  ASC ( RIGHT$ (LC$,1)) > 57 THEN 990
1060 HH = 0
1070  FOR I = 1 TO NS: IF LC$(I,0) = LC$ THEN HH = 1:K = I:I = NS + 1
1080  NEXT I
1090  IF HH = 0 THEN  PRINT : PRINT "SHELF ID IS NOT ON FILE.": PRINT : GOTO
     1000
1100  PRINT : PRINT BR$: PRINT "ID = ";LC$(K,0); SPC( 5);"SIZE= ";LC$(K,1)
     : PRINT "LOCATION: "DC$(K)
1110  PRINT : PRINT "PRESS ANY KEY TO CONTINUE ";: GET T$: PRINT : GOTO 790
1120  IF NS = 0 THEN  HOME : VTAB (5): PRINT "NO SHELVES ARE ON FILE!": PRINT
     : PRINT "BOOKS CANNOT BE ENTERED UNTIL": PRINT "SHELF ID'S ARE ON FILE!"
     : PRINT : GOTO 200
1130  GOSUB 1280
1140  PRINT D$;"OPEN SHELF"
1150  PRINT D$;"WRITE SHELF"
1160  PRINT NS
1170  FOR I = 1 TO NS: PRINT LC$(I,0): PRINT LC$(I,1): NEXT I
1180  FOR I = 1 TO NS: PRINT DC$(I): NEXT I
1190  PRINT D$;"CLOSE"
1200  PRINT D$;"RUN CATALOG MASTER"
1210  IF  PEEK (222) <  > 5 THEN  PRINT "ERROR CODE "; PEEK (222);" FOUND
     IN LINE "; PEEK (218) +  PEEK (219) * 256: END
1220  PRINT D$;"OPEN SHELF"
1230  PRINT D$;"WRITE SHELF"
1240 NN = 0
1250  PRINT NN
1260  PRINT D$;"CLOSE"
1270  GOTO 100
1280  REM  SUBROUTINE TO ORDER SHELF DIRECTORY
1290 F = 0:I = 1
1300  IF LC$(I,0) <  = LC$(I + 1,0) THEN 1350
1310 T1$ = LC$(I + 1,0):T2$ = LC$(I + 1,1):T3$ = DC$(I + 1)
1320 LC$(I + 1,0) = LC$(I,0):LC$(I + 1,1) = LC$(I,1):DC$(I + 1) = DC$(I)
1330 LC$(I,0) = T1$:LC$(I,1) = T2$:DC$(I) = T3$
1340 F = 1
1350 I = I + 1: IF I < NS THEN 1300
1360  IF F = 1 THEN 1290
1370  RETURN
```

HUNTINGTON COMPUTING

Softlights

By Fred Huntington

Time to tell you about a nifty little program that's been around a while that deserves some mention. The Menu Generator is an excellent program that everyone should use on every disk to create a HELLO program to take the typing out of running programs.

It creates menus quickly and painlessly. The publisher has even given permission to programmers to use the generated menus in commercial programs — no royalties. Comes complete with a free backup disk.

The usual price is $39.95. Our price **$33.89.** But until April 30, you can have it for **$27.99** (#9380).

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RANA DRIVES

We are now quite competitive on our Rana Drive prices. Give us a call for our new lower prices.

We also have the new Gibson high speed light pen at a discount. This is a knockout item. At press time our price was $296. Call for latest pricing. (#114)

Ice Demons is a nice new arcade game from the talented Matthew Jew. Listing at $29.95, our special this month is **$22.95.** (#7720).

Omega Microwave has an excellent new game out called A City Dies Whenever Night Falls. List price is $29.95 and our special is **$22.95.** The documentation that comes with this is unbelievable. And it is copyable and listable. (#707)

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Also from Omega, we're happy to be carrying their Ramex-128 128K board for only **$399** (a bargain even at the full list price of $499). It requires no removing of chips to install. It comes with powerful disk emulation software, which adds eight new DOS commands. It is the only 128K board that allows the user to load or save a full 136K VisiCalc file in 20 seconds. (#708)

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#119	CP/M Card (TM) - CP/M 3.0 (TM) + 64K memory + 6MHz speed.	Call for price
	AgDisk Agricultural software	CALL
#122	Compu-Music - Roland	**$429.00**

#230	Transtar 130 daisy wheel printer with boldface and underscore. Six mo. ltd. warranty	**$749.00**
#682	Taxan RGB color with board & cable	**$399.00**

All Santa Clara and Davong drives available at discount

#7380	Money Decisions (Eagle) special	**$149.00**

The Transtar 315 is a mind-blowing printer. It will dump any HIRES color screen in four-colors to the printer and to the paper. If you're playing a game, press the button and in a few seconds you'll have a four color printout of the screen. Traction or friction. Unbelievable. Should be ready for shipment shortly. Our price **$699.00** complete! (#231)

#33	PSIO Dual Function-Card - Videx	**$189.00**
#240	SRW Color Coder-5 different color library cases for carrying floppies	**$15.99**

We now have the complete line of Okidata printers. CALL

Child's Play is an incredible new piece of software written by Mike Taylor for children three to seven years old. It includes an etch-a-sketch, a series of mazes in which the cutest ant you ever saw is guided to his musical reward, and a series of quizzes which teach a child concepts of bigger than, different from, etc. Published by Huntington (with our daughter in mind) we have priced this so everyone can afford to enjoy it. The disk is crammed-packed and is only **$19.99.** Order #8999.

SSM has the hottest new modems in the business. Compatible with just about everything. The following specials are good through April.

#8562	Modemcard (300 baud)	**$239.00**
#8563	Modem 1200 (1200 BAUD)	**$549.00**

The following Transpaks include the ModemCard and the Source:

#8564	Transpak-1 (includes Transend 1)	**$309.00**
#8565	Transpak-2 (includes Transend 2)	**$349.00**
#8566	Transpak-3 (includes Transend 3)	**$529.00**

The following include 1200 baud modem and the Source

#8567	Transpak-2+ (includes Transend 2)	**$799.00**
#8568	Transpak-3+ (includes Transend 3)	**$899.00**

The following include the Source:

#8560	Transend 1	**$75.00**
#8561	Transend 2	**$119.00**
#8569	Transend 3	CALL

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CIRCLE 181 ON READER SERVICE CARD

book records. If the routine has been called by the Master routine for record modification, address 773 will contain 92, setting MOD=1, and bypassing program lines 160 through 390. The data needed for catalog number selection are not read in, and the program proceeds directly to the request for the book title. If a search is to be made on title, subject, or author, the cataloguing data are read in from the SC SEQ LIST text files.

After the necessary initializations, a menu is presented, and you select the type of search to be performed. If title is selected, the name of the book is entered, the first words or the entire title, and then the search is conducted on all data records. Instructions are given to insert data disks sequentially, with the total number of disks containing catalog data found in location 771, where it was POKEd by the Master routine.

When a match is found, the entire file is presented, as shown in Figure 8, and you then have the opportunity to end the search or to continue looking for other books with the same title. When the search is completed, the Search menu is returned to the screen.

Figure 8.
Sample Results of Search program.

```
- - - - - - - - - - - - - - - - - - -
TITLE: I HEAR AMERICA TALKING

AUTHOR: FLEXNER

LOCATION: JC1
SIZE (SMALL-NORMAL-TALL): T
CATEGORY: NON-FICTION
CATALOG NUMBER: 421
BOOK HAS NOT BEEN LOANED OUT.

CONTINUE SEARCH (Y/N)
```

The search on author is more complex since it is necessary to find all books by the given author or authors, even when they are included among the authors of a book with additional writers. The name(s) of the author is requested. For the case of multiple authors, the routine determines the number, and stores each name in an array.

In the case of a single author, the search proceeds through the data-containing disks. Byte 94, which contains the number of authors in the individual record, is examined. If the number is 1, then the name of the author is extracted from the record and compared to the given name. If the number on the record is greater than 1, then each of the authors in the record is compared to the given name. If the search is for a book with more than

Listing 7.

```
10  REM   PROGRAM TO CREATE SC SEQ LIST 0
20  DIM SC$(100)
30 D$ =  CHR$ (4)
40  FOR I = 1 TO 100: READ SC$(I): NEXT
50  PRINT D$;"OPEN SC SEQ LIST 0"
60  PRINT D$;"WRITE SC SEQ LIST 0"
70  FOR I = 1 TO 100: PRINT SC$(I): NEXT
80  PRINT D$;"CLOSE"
100  DATA  "GENERALITIES","KNOWLEDGE","THE BOOK","SYSTEMS","* "
110  DATA  "* ","* ","* ","* ","* "
120  DATA  "BIBLIOGRAPHY","BIBLIOGRAPHIES","OF INDIVIDUALS","OF WORKS BY S
     PFC CLASSES OF WRITERS","OF ANON & PSEUDON WRITERS"
130  DATA  "OF WORKS FROM SPFC PLACES","SUBJECT BIBLIOS & CATALOGS","GEN S
     UBJECT CATALOGS","AUTHOR & DATE CATALOGS","DICTIONARY CATALOGS"
140  DATA  "LIBRARY & INFO SCIENCES","LIBRARY RELATIONSHIPS","PHYSICAL PLA
     NT","PERSONNEL & POSITIONS","* "
150  DATA  "LIBRARY OPERATIONS","LIBRARIES FOR SPFC SUBJECTS","GENERAL LIB
     RARIES","READING & USE OF INFO MEDIA","* "
160  DATA  "GEN ENCYCLOPEDIC WORKS","AMERICAN","OTHERS IN ENGLISH","IN OTH
     ER GERMANIC LANGS","IN FRENCH- PROVENCAL- CATALAN"
170  DATA  "IN ITAL- ROMANIAN- RAETO-ROMANIC","IN SPANISH & PORTUGUESE","I
     N SLAVIC LANGS","IN SCANDINAVIAN LANGS","IN OTHER LANGS"
180  DATA  "* ","* ","* ","* ","* "
190  DATA  "* ","* ","* ","* ","* "
200  DATA  "GENERAL SERIAL PUBLICATIONS","AMERICAN","OTHERS IN ENGLISH","I
     N OTHER GERMANIC LANGS","IN FRENCH- PROVENCAL- CATALAN"
210  DATA  "IN ITAL- ROMANIAN-RHAETO-ROMANIC","IN SPANISH & PORTUGUESE","I
     N SLAVIC LANGS","IN SCANDINAVIAN LANGS","IN OTHER LANGS"
220  DATA  "GENERAL ORGS & MUSEOLOGY","IN NORTH AMERICA","IN BRITISH ISLES
     ","IN CENTRAL EUROPE","IN FRANCE & MONACO"
230  DATA  "IN ITALY & ADJ TERRITORIES","IN IBERIAN PEN & ADJ ISL","IN E E
     UROPE","IN OTHER AREAS","MUSEOLOGY (MUSEUM SCI)"
240  DATA  "JOURNALISM- PUBLISHING- NEWSPAPERS","IN N AMER","IN BRITISH IS
     LES","IN C EUROPE","IN FRANCE & MONACO"
250  DATA  "IN ITALY & ADJ TERRS","IN IBERIAN PEN & ADJ ISL","IN E EUROPE"
     ,"IN SCANDINAVIA","IN OTHER AREAS"
260  DATA  "GENERAL COLLECTIONS","AMERICAN","OTHERS IN ENGLISH","IN OTHER
     GERMANIC LANGS","IN FRENCH- PROCENCAL-CATALAN"
270  DATA  "IN ITAL- ROMANIAN- RHAETO-ROMANIC","IN SPANISH & PORTUGUESE","
     IN SLAVIC LANGS","IN SCANDINAVIAN LANGS","IN OTHER LANGS"
280  DATA  "MSS & BOOK RARITIES","MSS","BLOCK BOOKS","INCUNABULA","PRINTED
      BOOKS"
290  DATA  "BOOKS NOTABLE FOR BINDINGS","NOTABLE ILLUST & MATLS","NOTABLE
     OWNERSHIP OR ORIGIN","WORKS NOTABLE FOR CONTENT","BOOKS NOTABLE FOR F
     ORMAT"
```

```
10  REM    PROGRAM TO CREATE SC SEQ LIST 1
20  DIM SC$(100)
30 D$ =  CHR$ (4)
40  FOR I = 1 TO 100: READ SC$(I): NEXT
50  PRINT D$;"OPEN SC SEQ LIST 1"
60  PRINT D$;"WRITE SC SEQ LIST 1"
70  FOR I = 1 TO 100: PRINT SC$(I): NEXT
80  PRINT D$;"CLOSE"
100  DATA  "PHILOSOPHY & REL DISCIPLINES","THEORY OF PHIL","MISC OF PHIL",
     "DICTIONARIES OF PHIL","* "
110  DATA  "SERIALS ON PHIL","ORGANIZATIONS OF PHIL ","STUDY & TEACHING OF
      PHIL","TREATMENT AMONG GROUPS OF PERSONS","HISTORICAL TREATMENT OF P
     HIL"
120  DATA  "METAPHYSICS","ONTOLOGY","* ","COSMOLOGY","SPACE"
130  DATA  "TIME","EVOLUTION","STRUCTURE","FORCE & ENERGY","NUMBER & QUANT
     ITY"
140  DATA  "EPSTEMLOGY-CAUSTION- HMNKIND","EPISTEMOLOGY","CAUSATION","DETE
     RMINISM & INDETERMINISM","TELEOLOGY"
150  DATA  "* ","THE SELF","UNCONSCIOUS & SUBCONSCIOUS","HUMANKIND","ORIGI
     N & DESTINY OF INDIV'AL SOULS"
160  DATA  "PARANORMAL PHENOMENA & ARTS","WELL-BEING- HAPPINESS- SUCCESS",
     "* ","PARAPSYCHOLOGY & OCCULTISM","* "
170  DATA  "DREAMS & MYSTERIES","* ","ANALYTIC & DIVINATORY GRAPHOLOGY","P
     HYSIOGNOMY","PHRENOLOGY"
180  DATA  "SPECIFIED PHILOSOPHICAL VIEWPOINTS","IDLSM & RELTD SYS & DOCTR
     NS","CRITICAL PHILOSOPHY","INTUITIONISM & BERGSONISM","HUMANISM & REL
     ATED SYSTEMS"
190  DATA  "SENSATIONALISM & IDEOLOGY","NATURALISM & RELATED SYSTEMS","PAN
     THEISM & RELATED SYSTEMS","LIBERALISM & OTHER SYSTEMS","OTHER SYSTEMS
      & DOCTRINES"
200  DATA  "PSYCHOLOGY","* ","PHYSIOLOGICAL PSYCHOLOGY","INTELLIGENCE & IN
     TELLECT","SUBCONSCIOUS STATES & PROCESSES"
210  DATA  "DIFFERENTIAL & GENETIC PSYCHOLOGY","COMPARATIVE PSYCHOLOGY","A
     BNORMAL & CLINICAL PSYCHOLOGY","APPLIED PSYCHOLOGY","OTHER ASPECTS"
220  DATA  "LOGIC","INDUCTION","DEDUCTION","* ","* "
230  DATA  "FALLICIES & SOURCES OF ERROR","SYLLOGISMS","HYPOTHESES","ARGUM
     ENT & PERSUASION","ANALOGY"
240  DATA  "ETHICS (MORAL PHILOSOPHY)","SYSTEMS & DOCTRINES","POLITICAL ET
     HICS","ETHICS OF FAMILY RELATIONSHIPS","PROFESSIONAL & OCCUP'AL ETHIC
     S"
250  DATA  "ETHICS OF RECREATION & LEISURE","ETHICS OF SEX & REPRODUCTION"
     ,"ETHICS OF SOCIAL RELATIONSHIPS","ETHICS OF CONSUMPTION","OTHER ETHI
     CAL NORMS"
```

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BY BERT KERSEY

SHAPE EDITOR: Keyboard-draw shapes for hi-res animation in your programs. Design proportionally-spaced typefaces with special characters. 6 fonts on the disk. Listable demos show how to use shape tables to animate games, graphics and professional Charts & Graphs.

BYTE-ZAP: Rewrite any byte on a disk for repair or alteration. Load entire sectors on the screen for inspection. Hex/Dec/Ascii displays and input. Complete instructions for making trick file names, restoring deleted files, etc.

MORE: Useful music, text and hi-res tricks for your programs. Educational documentation.

APPLE MECHANIC: $29.50
(Includes Peeks/Pokes Chart & Tip Book#5)

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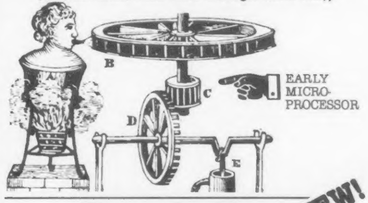
Typefaces

FOR APPLE MECHANIC

26 NEW FONTS for Apple Mechanic's Xtyper and Hi-Writer programs. Most are full 96-character fonts, large & small, of fully-editable characters. (Apple Mechanic required)

BEAGLE MENU: Use with your disks. Display only the filenames you want (e.g. only Applesoft files or only Locked files) for one-key cursor selection/execution. Space-on-disk, catalog scan, optional sector-number elimination.

TYPEFACES for Apple Mechanic: $20.00
(Includes Peeks/Pokes Chart & Beagle Menu Utility)



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COMPARE BEAGLE BAG with any one-game locked-up game disk on the market today. All 12 games are a blast, the price is right, the instructions are crystal clear, AND the disk is copyable. You can even change the programs or list them to LEARN, and see what makes them tick.

BEAGLE MENU TOO: See "Typefaces" above.

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Flex Text

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BY MARK SIMONSEN

PRINT VARIABLE-WIDTH TEXT on the hi-res screens with normal Applesoft commands (including Htab 1-70). Normal, expanded & compressed text on same screen— no hardware!

ADD GRAPHICS TO TEXT or vice-versa. Run existing programs under Flex Text control. Easy to use and compatible with PLE© and GPLE.©

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(Includes Peeks/Pokes Chart; requires monitor)

Utility City

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BY BERT KERSEY

LIST FORMATTER prints each program statement on a new line. Loops indented with printer page breaks. A great de-bugger! Also...

MULTI-COLUMN catalogs for printouts, autopost Run-number & Date in programs, put invisible commands in programs, create INVISIBLE file names, alphabetize/store info on disk, convert decimal to hex or INT to FP, renumber to 65535, append programs, dump text-screen to printer...

MORE TOO: 21 Programs Total, a best-seller!

UTILITY CITY: $29.50
(Includes Peeks/Pokes Chart & Tip Book#3)

```
10  FOR A = 1 TO 22: PRINT CHR$(ASC (MID$(
   "IJ—!IPX(T!ZPVS!TJTUFS@", A, 1))—A/A);
20  FOR B = 1 TO 4: C = PEEK(49200): NEXT B, A
```

DOS Boss

DISK COMMAND EDITOR

BY BERT KERSEY & JACK CASSIDY

RENAME COMMANDS & ERROR MESSAGES: "Catalog" can be "C"; "Syntax Error" can be "Oops" or anything you want. Protect your programs; unauthorized save-attempt can produce "Not Copyable" message. Also LIST-prevention and one-key program-run from catalog.

CUSTOMIZE DOS: Change Disk Volume heading to your message. Omit/alter catalog file codes. Fascinating documentation and tips; hours of juicy reading and Apple experiments.

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100 LISTABLE PROGRAMS from Beagle Bros Tip Books 1-4. Make your Apple do things its never done! All programs changeable for experimentation. Includes our Apple Command Chart: ALL Applesoft, Integer & DOS Commands!

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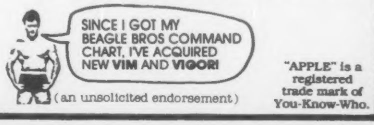
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BY TOM WEISHAAR

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Function	Normal	Pronto
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BSAVE HI-RES IMAGE	12 sec.	6 sec.
LOAD 60-SECTOR PROGRAM	16 sec.	4 sec.
SAVE 60-SECTOR PROGRAM	24 sec.	9 sec.
BLOAD LANGUAGE CARD	13 sec.	4 sec.
TEXT FILES	(no change)	

BOOT PRONTO-DOS or any updated normal-3.3 disk. Create new ProntoDos disks with the normal INIT command. ProntoDos is compatible with ALL DOS COMMANDS and performs normally with almost ALL programs, including CopyA.

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COMPRESS HI-RES PIX to 1/3 Disk-Space. Superimpose pages or re-locate any rectangular image area anywhere on either hi-res page.

HI-RES TEXT: Proportional spacing, adjustable character size and color, upper/lower case, no tab limits, sideways typing for graphs.

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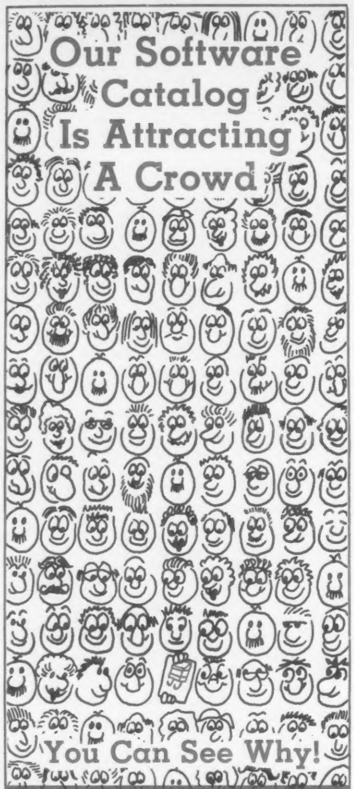
CIRCLE 114 ON READER SERVICE CARD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CIRCLE 265 ON READER SERVICE CARD

Library Catalog, continued...

```
260  DATA  "ANCIENT- MED'VL & ORIENTAL PHIL","ORIENTAL","PRE-SOCRATIC GREE
     K","SOPHSTIC- SOCRATIC & REL GRK","PLATONIC"
270  DATA  "ARISTOTELIAN","SKEPTIC & NEOPLATONIC","EPICUREAN","STOIC","MED
     IEVAL WESTERN"
280  DATA  "MODERN WESTERN PHILOSOPHY","U.S. & CANADA","BRITISH ISLES","GE
     RMANY & AUSTRIA","FRANCE"
290  DATA  "ITALY","SPAIN & PORTUGAL","RUSSIA & FINLAND","SCANDANAVIA","OT
     HER GEOGRAPHICAL AREAS"

10  REM     PROGRAM TO CREATE SC SEQ LIST 2
20  DIM SC$(100)
30 D$ =  CHR$ (4)
40  FOR I = 1 TO 100: READ SC$(I): NEXT
50  PRINT D$;"OPEN SC SEQ LIST 2"
60  PRINT D$;"WRITE SC SEQ LIST 2"
70  FOR I = 1 TO 100: PRINT SC$(I): NEXT
80  PRINT D$;"CLOSE"
100  DATA  "RELIGION","PHILOSOPHY OF CHRISTIANITY","MISC OF CHRISTIANITY",
     "DICTIONAIES OF CHRISTIANITY","SPCL TOPICS OF GEN APPLCBLTY"
110  DATA  "SERIALS ON CHRISTIANITY","ORGS OF CHRISTIANITY","STUDY & TEACH
     ING OF CHRISTIANITY","CHRIST'ITY AMONG GROUPS OF PERSONS","HISTORY &
     GEOG OF CHRISTIANITY"
120  DATA  "NATURAL RELIGION","CONCEPTS OF GOD","NATURE OF GOD","CREATION"
     ,"THEODICY"
130  DATA  "SCIENCE & RELIGION","GOOD & EVIL","* ","HUMANKIND","ANALOGY"
140  DATA  "BIBLE","OLD TESTAMENT","HISTORICAL BOOKS OF O.T.","POETIC BOOK
     S OF O.T.","PROPHETIC BOOKS OF O.T."
150  DATA  "NEW TESTAMENT","GOSPELS & ACTS","EPISTLES","REVELATION (APOCAL
     YPSE)","APOCRYPHA & PSEUDEPIGRAPHA"
160  DATA  "CHRISTIAN THEOLOGY","GOD","JESUS CHRIST & HIS FAMILY","HUMANKI
     ND","SALVATION (SOTERIOLOGY) & GRACE"
170  DATA  "SPIRITUAL BEINGS","ESCHATOLOGY","* ","CREEDS & CONFESSIONS OF
     FAITH","APOLOGETICS & POLEMICS"
180  DATA  "CHRSTN MORAL & DEVTONAL THEOLGY","MORAL THEOLOGY","DEVOTIONAL
     LITERATURE","EVANGLSTIC WRTGS FOR INDVALS","* "
190  DATA  "HYMNS W/O MUSIC","ART IN CHRISTIANITY","CHURCH FURNISHINGS & A
     RTICLES","CHRSTN EXPRNCE- PRACT- LIFE","CHRISTIAN OBSERVANCES IN FAM
     LIFE"
200  DATA  "LOCAL CHURCH & REL ORDERS","PREACHING (HOMILETICS)","TEXTS OF
     SERMONS","SECULAR CLERGYMEN & DUTIES","PARISH GOVT & ADMIN"
210  DATA  "RELIG CONGS & ORDERS","* ","* ","* ","PAROCHICAL ACTIVITIES"
220  DATA  "SOCIAL & ECC'TAL THEOLOGY","SOCIAL THEOLOGY","ECCLESIOLOGY","T
     IMES & PLACES OF REL OBSERV","PUBLIC WORSHIP"
230  DATA  "OTHER RITES- CEREMONIES- ORDS","MISSIONS","ASSOC FOR RELIGIOUS
      WORK","RELIG TRAINING & INSTRUCTION","SPIRITUAL RENEWAL"
240  DATA  "HISTORY & GEOG OF CHURCH","RELIGIOUS CONGS & ORDERS","PERSECUT
     IONS","DOCTRINAL CONTROVERSIES & HERESIES","CHRISTIAN CHURCH IN EUROP
     E"
250  DATA  "CHRISTIAN CHURCH IN ASIA","CHRISTIAN CHURCH IN AFRICA","CHRSTN
      CHURCH IN N AMER","CHRISTIAN CHURCH IS S AMERICA","CHRISTIAN CHURCH
     IN OTHER AREAS"
260  DATA  "CHRISTIAN DENOMS & SECTS","PRIMITAVE & ORIENTAL CHURCHES","ROM
     AN CATHOLIC CHURCH","ANGLICAN CHURCHES","PROTESTANTS OF CONT'L ORIGIN
     "
270  DATA  "PRESB'TAN & RELATED CHURCHES","BAPTIST- DISCIPLES- ADVENTIST",
     "METHODIST CHURCHES","UNITARIANISM","OTHER DENOMS & SECTS"
280  DATA  "OTHER & COMPARATIVE RELIGIONS","COMPARATIVE RELIGION","CLASSIC
     AL (GRK & ROM) RELIGION","GERMANIC RELIGION","RELIGIONS OF INDIC ORIG
     IN"
290  DATA  "ZOROASTRIANISM","JUDAISM","ISLAM & RELIGIONS DERIVED FROM IT",
     "* ","OTHER RELIGIONS"

10  REM  PROGRAM TO CREATE SC SEQ LIST 3
20  DIM SC$(100)
30 D$ =  CHR$ (4)
40  FOR I = 1 TO 100: READ SC$(I): NEXT
50  PRINT D$;"OPEN SC SEQ LIST 3"
60  PRINT D$;"WRITE SC SEQ LIST 3"
70  FOR I = 1 TO 100: PRINT SC$(I): NEXT
80  PRINT D$;"CLOSE"
100  DATA  "SOCIAL SCIENCES","SOCIOLOGY","SOCIAL INTERACTION","SOCIAL PROC
     ESSES","RELATION OF NATURAL FACTORS"
110  DATA  "SOCIAL STRATIFICATION","CULTURE & INSTITUTIONS","COMMUNITIES "
     ,"* ","* "
120  DATA  "STATISTICS","* ","STATISTICS OF POPULATIONS","* ","GENERAL STA
     TISTICS OF EUROPE"
130  DATA  "GENERAL STATISTICS OF ASIA","GENERAL STATISTICS OF AFRICA","GE
     NERAL STATISTICS OF N AMERICA","GENERAL STATISTICS OF S AMERICA","GEN
     ERAL STATISTICS OF OTHER AREAS"
140  DATA  "POLITICAL SCIENCE ","KINDS OF GOVTS & STATES","RELATION OF STA
     TE TO SOCIAL GROUPS","RELATION OF STATE TO RESIDENTS","POLITICAL PROC
     ESS"
150  DATA  "INTERNATIONAL MIGRATION","SLAVERY & EMANCIPATION","INTERNATION
     AL RELATIONS","LEGISLATION","* "
160  DATA  "ECONOMICS","LABOR ECONOMICS","FINANCIAL ECONOMICS","LAND ECONO
     MICS","COOPERATIVES"
170  DATA  "SOCIALISM & RELATED SYSTEMS","PUBLIC FINANCE","INTERNATIONAL E
     CONOMICS","PRODUCTION","MACROECONOMICS & RELATED TOPICS"
180  DATA  "LAW","INTERNATIONAL LAW","CON & ADMIN LAW","MISC PUBLIC LAW","
     SOCIAL LAW"
```

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"Graphitti (Printer/Graphics Int.)	$110
"Expand-a-Ram. up to 128K	$195
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" 212 AutoCAT	$585
" 103 AutoCAT	$215
Universal 103 Line Powered	$165
" ". auto answer	$205
" 202. 1200 baud. half duplex	$185
" 212. 1200 baud. full duplex	$445

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AST RESEARCH CARDS NOW INCLUDE SPOOLER AND DISK EMULATOR SOFTWARE	NO EXTRA CHARGE
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Extra Memory Pages (kit) INCLUDED—No Charge

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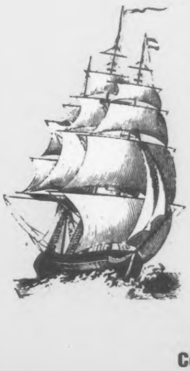
2716 Eprom	$4.00
2732 Eprom	$6.50
6116 2K×8 Static RAM. 200ns	$5.00
6116 ". 150ns	$5.50



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one author, the search immediately proceeds to look at only books with that or a greater number of authors for a match.

In all cases, if a match is found, the entire record is shown on the screen, and the operator has the opportunity to end the search or to continue the search for additional books by the author or authors.

The search on subject goes through the same process as the entry procedure in that the catalog divisions are shown on the screen and you have the opportunity to select the area of interest. The one change here is that the opportunity is given to search on any of the three levels of categorization. Once the catalog number is selected, the routine jumps to a section which searches each of the data records at byte 82 for a match. The entire record and continue/stop option are presented.

In the modify usage of the Search program, the cataloguing data are not read in, and after entry of the title, the search proceeds for the book. When found, the choice of modifying the record, deleting the record, or leaving the record unchanged is presented. If modification is selected, the first choice is to check in/check out the book. If this is the need, the book is either checked in and the shelf location shown, or the borrower's name is requested. These data are then inserted in the book record.

If the record is to be changed, each entry in it is presented individually, with the option of change/no change available each time. Once again, with a modification, you have the opportunity to continue the search for different books with the same title or to end the search.

When a record is selected for deletion, the last record on the disk is rewritten over the record to be deleted,

COMPUTER CENTER
TER
CARP

"Been a long day, huh Harry!"

```
190  DATA  "CRIMINAL LAW","PRIVATE LAW","CIVIL PROCEDURE & COURTS","STATUT
     ES- REGS- CASES","LAW OF INDIV'AL STATES & NATIONS"
200  DATA  "PUBLIC ADMINISTRATION","CENTRAL GOVTS","LOCAL GOVTS","US FEDER
     AL & STATE GOVTS","OTHER CENTRAL GOVTS"
210  DATA  "MILITARY ART & SCI","FOOT FORCES & WARFARE","MOUNTED FORCES &
     WARFARE","ARMORED- TECH- AIR- SPACE FORCES","SEA FORCES & WARFARE"
220  DATA  "SOCIAL PROBLEMS & SERVICES","SOCIAL PROBLEMS & WELFARE","SOCIA
     L WELFARE PROBS & SERVICES","OTHER SOCIAL PROBS & SERVICES","CRIMINOL
     OGY"
230  DATA  "PENAL INSTITUTIONS","ASSOCIATION","GENERAL CLUBS","INSURANCE",
     "MISC KINDS OF ASSOC'S"
240  DATA  "EDUCATION","GENERALITIES OF ED","ELEMENTARY ED","SECONDARY ED"
     ,"ADULT ED"
250  DATA  "CURRICULUMS","ED OF WOMEN","SCHOOLS & RELIGION","HIGHER ED","E
     D & THE STATE"
260  DATA  "COMMERCE (TRADE)","INTERNAL COMMERCE","INTERNATIONAL COMM","PO
     STAL COMMUN","OTHER SYSTEMS OF COMMUN"
270  DATA  "RAILROAD TRANSPORT","INLAND WATERWAY & FERRY","WATER- AIR- SPA
     CE TRANS","GROUND TRANS","METROLOGY & STANDARDIZATION"
280  DATA  "CUSTOMS- ETIQUETTE- FOLKLORE","COSTUME & PERSONAL APPEARANCE",
     "CUST OF LIFE CY & DOM LIFE","DEATH CUSTOMS","GENERAL CUSTOMS"
290  DATA  "ETIQUETTE (MANNERS)","* ","* ","FOLKLORE","CUSTOMS OF WAR & DI
     PLOMACY"
```

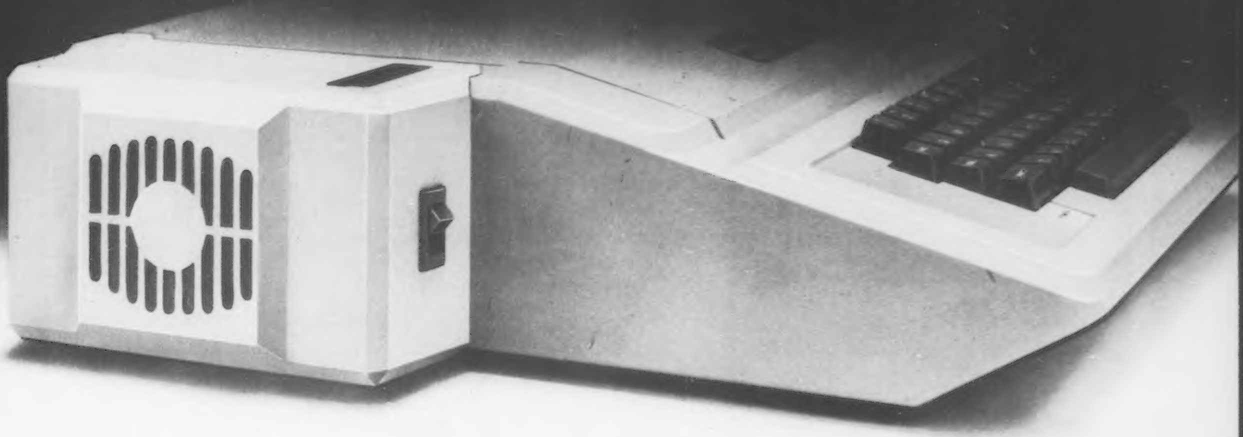
```
10  REM   PROGRAM TO CREATE SC SEQ LIST 4
20  DIM SC$(100)
30 D$ =  CHR$ (4)
40  FOR I = 1 TO 100: READ SC$(I): NEXT
50  PRINT D$;"OPEN SC SEQ LIST 4"
60  PRINT D$;"WRITE SC SEQ LIST 4"
70  FOR I = 1 TO 100: PRINT SC$(I): NEXT
80  PRINT D$;"CLOSE"
100  DATA  "LANGUAGE","PHILOSOPHY & THEORY","MISC","DICTIONARIES & ENCLYCL
     OPEDIAS","SPECIAL TOPICS OF GEN APPLIC"
110  DATA  "SERIAL PUBLICATIONS","ORGANIZATIONS","STUDY & TEACHING","TREAT
     MENT AMONG GROUPS OF PERSONS","HIST & GEOG TREATMENT"
120  DATA  "LINGUISTICS","NOTATIONS","ETYMOLOGY","POLYGLOT DICTIONARIES","
     PHONOLOGY"
130  DATA   "STRUCTURAL SYSTEMS (GRAMMAR)","* ","DIALECTOLOGY & PALEOGRAPH
     Y","USAGE (APPLIED LIINGUISTICS)","VERBAL LANG NOT SPOKEN OR WRITTEN"

140  DATA  "ENGLISH & ANGLO-SAXON LANGS","WRITTEN & SPOKEN ENG","ENG ETYMO
     LOGY","ENG DICTIONARIES","* "
150  DATA  "ENG STRUCTURAL SYSTEM","* ","NONSTANDARD ENG","STANDARD ENG US
     AGE","ANGLO-SAXON (OLD ENG)"
160  DATA  "GERMANIC LANGS","WRITTEN & SPOKEN GER","GER ETYMOLOGY","GER DI
     CTIONARIES","* "
170  DATA  "GER STRUCTURAL SYSTEM ","* ","NONSTANDARD GER","STD GER USAGE"
     ,"OTHER GERMANIC LANGS"
180  DATA  "ROMANCE LANGS- FRENCH","WRITTEN & SPOKEN FR","FR ETYMOLOGY","F
     R DICTIONARIES","* "
190  DATA  "FR STRUCTURAL SYSTEM","* ","NONSTD FR","STD FR USAGE","PROVENC
     AL & CATLAN"
200  DATA  "ITAL- ROMANIAN- RHAETO-ROMANIC","WRITTEN & SPOKEN ITAL","ITAL
     ETYMOLOGY","ITAL DICTIONARIES","* "
210  DATA  "ITAL STRUCTURAL SYSTEM","* ","NONSTD ITAL","STD ITAL USAGE","R
     OMANIAN & RHAETO-ROMANIC"
220  DATA  "SPANISH & PORT LANGS","WRITTEN & SPOKEN SP","SP ETYMOLOGY","SP
      DICTIONARIES","* "
230  DATA  "SP STRUCTURAL SYSTEM","* ","NONSTD SP","STD SP USAGE","PORTUGU
     ESE"
240  DATA  "ITALIC LANGS- LATIN","WRITTEN & SPOKEN CLASSICAL LATIN","CLASS
      LATIN ETYMOLOGY","CL LATIN DICTIONARIES","* "
250  DATA  "CL LATIN STRUCTURAL SYSTEM","* ","OLD- POSTCLASSICAL- VULGAR L
     ATIN","CL LATIN USAGE","OTHER ITALIC LANGS"
260  DATA  "HELLENIC LANGS-CLASSICAL GREEK","WRITTEN & SPOKEN CLASSICAL GR
     ","CLASSICAL GR ETYMOLOGY","CLASSICAL GR DICTIONARIES","* "
270  DATA  "CLASSICAL GREEK STRUCTURAL SYSTEM","* ","POSTCLASSICAL GR","CL
     ASSICAL GR USAGE","OTHER HELLENIC LANGS"
280  DATA  "OTHER LANGS","EAST INDO-EUR & CELTIC","AFRO-ASIATIC (HAMITO-SE
     MITIC)","HAMITIC & CHAD LANDS","URAL-ALTAIC-PALEOSBRIAN-DRAVIDIAN"
290  DATA  "SINO-TIBETAN & OTHER","AFRICAN LANGS","N AMER NATIVE LANGS","S
      AMER NATIVE LANGS","OTHER LANGS"
```

```
10  REM    PROGRAM TO CREATE SC SEQ LIST 5
20  DIM SC$(100)
30 D$ =  CHR$ (4)
40  FOR I = 1 TO 100: READ SC$(I): NEXT
50  PRINT D$;"OPEN SC SEQ LIST 5"
60  PRINT D$;"WRITE SC SEQ LIST 5"
70  FOR I = 1 TO 100: PRINT SC$(I): NEXT
80  PRINT D$;"CLOSE"
100  DATA  "PURE SCIENCES","PHILOSOPHY & THEORY' ,"MISC","DICTIONARIES & EN
     CY","* "
110  DATA  "SERIAL PUBS","ORANIZATIONS","STUDY & TEACHING","TRAVEL & SURVE
     YS","HISTORICAL & GEOG TREATMENT"
120  DATA  "MATHEMATICS","GENERALITIES","ALGEBRA","ARITHMETIC","TOPOLOGY"
130  DATA  "ANALYSIS","GEOMETRY","* ","* ","PROBABILITIES & APPLIED MATH"
140  DATA  "ASTRONOMY & ALLIED SCI","THEORETICAL ASTRONOMY","PRACTICAL & S
     PHERICAL ASTRONOMY","DESCRIPTIVE ASTRONOMY","* "
```

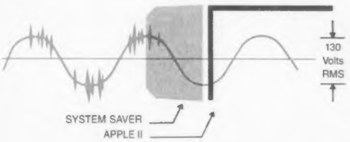
System Saver™

The most important peripheral for your Apple® II.



For Line Surge Suppression

The SYSTEM SAVER provides essential protection to hardware and data from dangerous power surges and spikes.

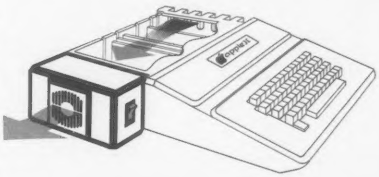


By connecting the Apple II power input through the SYSTEM SAVER, power is controlled in two ways: 1) Dangerous voltage spikes are clipped off at a safe 130 Volts RMS/175 Volts dc level. 2) High frequency noise is smoothed out before reaching the Apple II. A PI type filter attenuates common mode noise signals by a minimum of 30 dB from 600 khz to 20 mhz, with a maximum attenuation of 50 dB.

For Cooling

As soon as you move to 64K RAM or 80 columns on your Apple II you need SYSTEM SAVER.

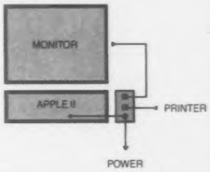
Today's advanced peripheral cards generate more heat. In addition, the cards block any natural air flow through the Apple II creating high temperature conditions that substantially reduce the life of the cards and the computer itself.

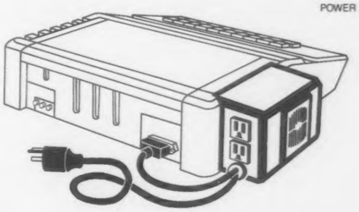


SYSTEM SAVER provides correct cooling. An efficient, quiet fan draws fresh air across the mother board, over the power supply and out the side ventilation slots.

For Operating Efficiency

SYSTEM SAVER contains two switched power outlets. As shown in the diagram, the SYSTEM SAVER efficiently organizes your system so that one convenient, front mounted power switch controls SYSTEM SAVER, Apple II, monitor and printer.

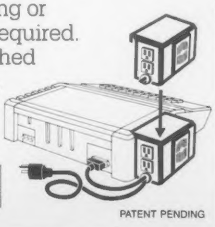




The heavy duty switch has a pilot light to alert when system is on. You'll never use the Apple power switch again!

Easy Installation

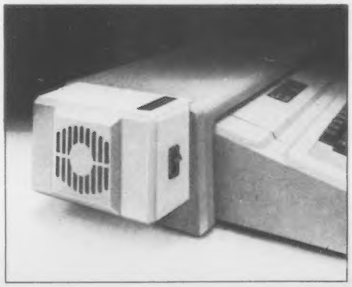
Just clips on.
No mounting or
hardware required.
Color matched
to Apple II.



UL LISTED

PATENT PENDING

Compatible with Apple Stand



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and the number of records stored in record zero is decreased by one. A message is printed to the screen when the disk is emptied of catalog data.

HIMEM is changed during the running of this routine, as in the Enter routine, for reasons given below.

Catalog List, Catalog Borrow, And Catalog Bookshelf

Catalog List (Listing 4) is provided for those times when you don't really know what book you want, but would just like to browse through your collection. The only information provided here is the title and author, as the listing is scrolled on the screen.

Catalog Borrow (Listing 5) presents two options. A selection is made by listing either all books out on loan or all books on loan to a given person. The key upon which this search is made is byte 96 of each record. If this byte is 0 the book should be on the shelf, and if it is 1 the book is out on loan.

Catalog Bookshelf (Listing 6) is the first routine that must be run when the Library Catalog program is used for the first time. The Enter routine will not permit a book to be entered on a non-existent shelf.

The menu presented by this routine offers a choice of new shelf entry, shelf removal, directory of all existing shelves, and ending shelf operations. For shelf entry the information required is the shelf ID, the tallest book the shelf can accommodate — in the form S-short, N-normal, T-tall — and a short free-form description of where the shelf is. This description is placed in the directory for later reference. Only the usual commas and quotation marks are prohibited from this statement.

The routine checks for the proper ID format, i.e., Letter Letter Number; existence of a shelf prior to its removal; and duplication of a shelf ID prior to the addition of a new shelf. The routine currently allows 200 shelves, but this can be changed by modifying statement 50. The last operation the Borrow routine does prior to running Master is to alphabetize the shelf ID listing and restore it to the SHELF text file.

Program Particulars Data

The format for the book record file is shown in Table 2. Programmers are encouraged to modify this program to fit the more particular needs of their own library, but care must be taken, such as allowing space in the file for returns and possible variability of data length. As explained above, the program looks for certain data at given

```
150  DATA  "EARTH (ASTRO GEOG)","MATHEMATICAL GEOGRAPHY","CELESTIAL NAVIGA
     TION","EPHEMERIDES (NAUTICAL ALMANACS)","CHRONOLOGY (TIME)"
160  DATA  "PHYSICS","MECHANICS","MECHANICS OF FLUIDS","MECHANICS OF GASES
     ","SOUND & RELATED VIBRATIONS"
170  DATA  "LIGHT & PARAPHOTIC PHENOM","HEAT","ELECTRICITY & ELECTRONICS",
     "MAGNETISM","MODERN PHYSICS"
180  DATA  "CHEM & ALLIED SCIENCES","PHYSICAL & THEORETICAL CHEM","LABS- A
     PPARATUS- EQUPT","ANALYTICAL CHEM","QUALITATIVE CHEM"
190  DATA  "QUANT CHEM","INORGANIC CHEM","ORGANIC CHEM","CRYSTALLOGRAPHY",
     "MINERALOGY"
200  DATA  "SCIENCES OF EARTH & OTHER WORLDS","GEOLOGY- METEOROLOGY- HYDRO
     LOGY","PETROLOGY (ROCKS)","ECONOMIC GEOLOGY","TREATMENT IN EUROPE"
210  DATA  "TREATMENT IN ASIA","TREATMENT IN AFRICA","TREATMENT IN N AMER"
     ,"TREATMENT IN S AMER","TREATMENT IN OTHER AREAS & WORLDS"
220  DATA  "PALEONTOLGY","PALEOBOTANY","FOSSIL INVERTEBRATES","FSL PROTOZO
     A& OTHER SIMP ANMLS","FOSSIL MOLLUSCA & MOLLUSCOIDEA"
230  DATA  "OTHER FOSSIL INVERTEBRATES","FOSSIL CHORDATA","FOSSIL COLD-BLO
     DDED VERTEBRATES","FOSSIL AVES (BIRDS)","FOSSIL MAMMALIA"
240  DATA  "LIFE SCIENCES","* ","HUMAN RACES","PHYSICAL ANTHROPOLOGY","BIO
     LOGY"
250  DATA  "ORGANIC EVOLUTION & GENETICS","MICROBES","GEN NATURE OF LIFE",
     "MICROSCOPY IN BIO","COLL &PRES OF SPCMNS"
260  DATA  "BOTANICAL SCIENCES","BOTANY","SPERMATOPHYTA","DICOTYLEDONES","
     MONOCOTYLEDONES"
270  DATA  "GYMNOSPERMAE","CRYPTOGAMIA","PTERIDOPHYTA","BRYOPHYTA","THALLO
     PHYTA"
280  DATA  "ZOOLOGICAL SCIENCES","ZOOLOGY","INVERTEBRATES","PROTOZOA & OTH
     ER SIMPLE ANIMALS","MOLLUSCA AND MOLLUSCOIDEA"
290  DATA  "OTHER INVERTEBRATES","CHORDATA","COLD BLOODED VERTEBRATES","AV
     ES (BIRDS)","MAMMALIA"
```

```
10  REM  PROGRAM TO CREATE SC SEQ LIST 6
20  DIM SC$(100)
30 D$ =  CHR$ (4)
40  FOR I = 1 TO 100: READ SC$(I): NEXT
50  PRINT D$;"OPEN SC SEQ LIST 6"
60  PRINT D$;"WRITE SC SEQ LIST 6"
70  FOR I = 1 TO 100: PRINT SC$(I): NEXT
80  PRINT D$;"CLOSE"
100  DATA  "TECHNOLOGY (APPLIED SCIENCE)","PHILOSOPHY & THEORY","MISC","DI
     CTIONARIES & ENCYCLOS","GENERAL TECHNOLOGIES"
110  DATA  "SERIAL PUBS","ORGANIZATIONS & MANAGEMENT","STUDY & TEACHING","
     INVENTIONS & PATENTS","HISTORICAL & GEOG TREATMENT"
120  DATA  "MEDICAL SCI - MEDICINE","HUMAN ANATOMY- CYTOLOGY- TISSUES","HU
     MAN PHYSIOLOGY","GENERAL & PERSONAL HYGINE","PUBLIC HEALTH & RELATED
     TOPICS"
130  DATA  "PHARMACOLOGY & THERAPUTICS","DISEASES","SURGERY & RELATED TOPI
     CS","OTHER BRANCHES OF MEDICINE","EXPERIMENTAL MEDICINE"
140  DATA  "ENGINEERING & ALLIED OPERATIONS","APPLIED PHYSICS","MINING & R
     ELATED OPS","MILITARY & NAUTICAL ENG","CIVIL ENG"
150  DATA  "RR'S- ROADS- HIGHWAYS","* ","HYDRAULIC ENG","SANITARY & MUNICI
     PAL ENG","OTHER BRANCHES"
160  DATA  "AGRICULTURE & RELATED TECHS","CROPS & THEIR PRODUCTION","PLANT
      INJURIES- DISEASES- PESTS","FIELD CROPS","ORCHARDS- FRUITS- FORESTRY
     "
170  DATA  "GARDEN CROPS- VEGETABLES","ANIMAL HUSBANDRY","DAIRY & RELATED
     TECHS","INSECT CULTURE","NONDOMESTIC ANIMALS & PLANTS"
180  DATA  "HOME EC & FAMILY LIVING","FOOD & DRINK","MEAL & TABLE SERVICE"
     ,"HOUSING & HOUSEHOLD EQUIP","HOUSEHOLD UTILITIES"
190  DATA  "FURNISHING & DECORATING HOME","SEWING- CLOTHING & PERSONAL LIV
     ING","PUBLIC HOUSEHOLDS","HOUSEKEEPING","CHILD REARING & CARE OF SICK
     "
200  DATA  "MGMT & AUX SERVICES","OFFICE SERVICES","WRITTEN COMMUN PROCESS
     ES","SHORTHAND","* "
210  DATA  "* ","* ","ACCOUNTING","GENERAL MGMT","ADVERTISING & PR"
220  DATA  "CHEMICAL & RELATED TECHNOLOGIES","INDUSTRIAL CHEMICALS","EXPLS
     VES- FUELS- RLTD PRODS","BEVERAGE TECH","FOOD TECH"
230  DATA  "INDSTL OILS-FATS-WAXES-GASES","CERAMIC & ALLIED TECHS","CLEANI
     NG-COLOR- OTHER TECHS","OTHER ORGANIC PRODUCTS","METALLURGY"
240  DATA  "MANUFACTURES","METAL MANUFACTURES","FERROUS METALS MAN","NONFE
     RROUS METALS MAN","LUMBER- CORK- WOOD TECHS"
250  DATA  "LEATHER & FUR TECHS","PULP & PAPER TECH","TEXTILES","ELASTOMER
     S & THEIR PRODUCTS","OTHER PRODUCTS OF SPECIFIC MATLS"
260  DATA  "MANUFACTURE FOR SPECIFIC USES","PRECISION & OTHER INSTRUMENTS"
     ,"SMALL FORGE WORK","HARDWARE & HOUSEHOLD APPLIANCES","FURNISHINGS &
     HOME WORKSHOPS"
270  DATA  "LEATHER & FUR GOODS","PRINTING & RELATED ACTIVITIES","CLOTHING
     ","OTHER FINAL PRODS & PACKAGING","* "
280  DATA  "BUILDINGS","BUILDING MATLS","AUX CONSTRUCTION PRACTICES","CONS
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290  DATA  "ROOFING","UTILITIES","HVAC","DETAIL FINISHING","* "
```

```
10  REM   PROGRAM TO CREATE SC SEQ LIST 7
20  DIM SC$(100)
30 D$ =  CHR$ (4)
40  FOR I = 1 TO 100: READ SC$(I): NEXT
50  PRINT D$;"OPEN SC SEQ LIST 7"
60  PRINT D$;"WRITE SC SEQ LIST 7"
```

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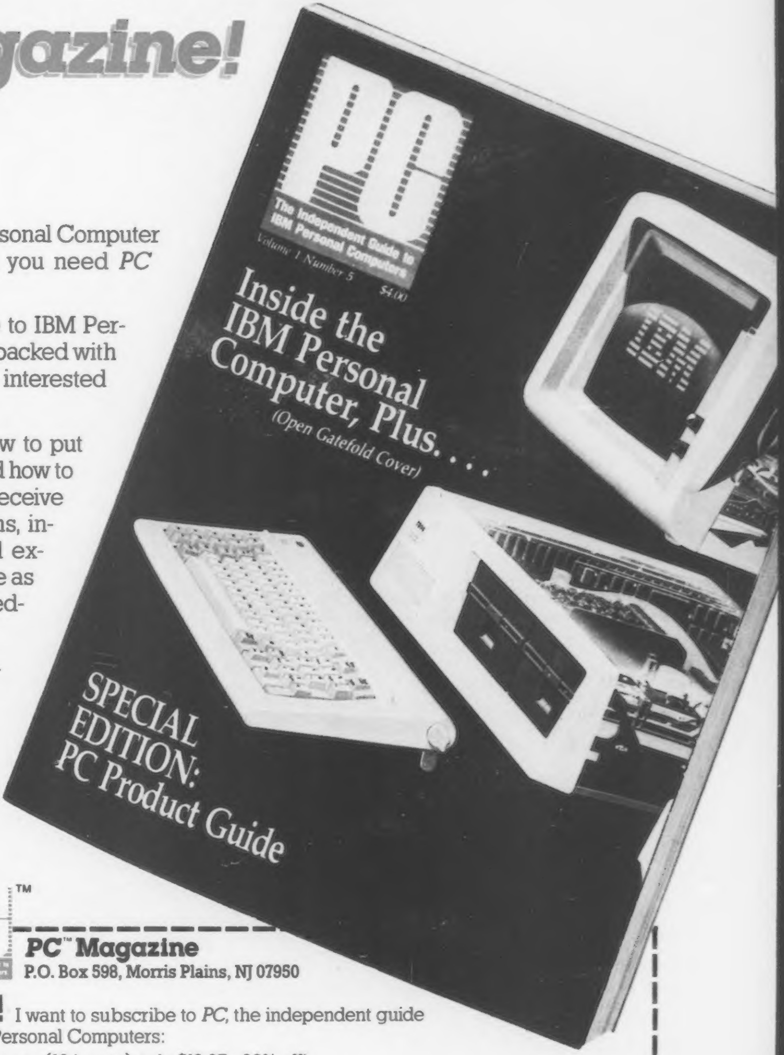
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byte locations in the file, and changes will destroy the input.

Increasing Search Speed

In working with strings, one characteristic that the Apple has that can become annoying is the stockpiling of "old" strings after they have been updated. As described on page 53 of the Applesoft manual, if the title variable TL$= WAR AND PEACE one time and GRIMM'S FAIRY TALES the next, the string WAR AND PEACE remains in the attic of memory, and GRIMM'S is placed below it.

As dozens of strings with book information are manipulated and compared, the available memory constantly decreases until string storage runs into program and array storage which is working its way up from the basement. Old strings can be cleared away periodically in a program with the statement X=FRE(0), or the machine will do the job itself when the available memory is depleted.

With the large number of strings that the Enter and Search programs require for the catalog classification data (approximately 15K bytes) the housekeeping, which examines all strings in memory, can take almost two minutes. I found it very disconcerting during a search to listen to the hum of the disk drive looking for the desired book only to have the whole process stop dead while the machine cleaned house.

The solution to this problem is found in the way the Apple treats the strings. String storage starts at HIMEM and works down towards the program and array storage area. The Enter and Search routines have been structured so that the 1000 strings of catalog classification data are read in at the beginning of the routines, filling the space below the original setting of HIMEM, 38400 ($9600). Recall that as shown on the memory map in the DOS manual the memory between the top of a 48K machine, 49151 ($BFFF) and 38400 ($9600) is lost to DOS use.

After the Enter and Search routines load the catalog classifications, HIMEM is set at 20000 ($4E20), leaving only a few thousand locations available for the new strings that are entered and manipulated. This is ample room, but only requires tenths of a second for the Apple to houseclean when the need arises. Moving HIMEM down has eliminated the unnecessary search through the catalog classification data strings during each housecleaning. Prior to running the Master program, HIMEM is once again set to the original value.

Entering Catalog Classification Data

The heart of the catalog classification routine is the selection process from the 1000 subcategories of the Dewey Decimal System. The information required for this classification is stored in ten subcategory sequential data files, for example, SC SEQ LIST 3. These files can be created from the programs shown in Listing 7. The use of a file editor such as EDASM in the Applesoft Tool Kit greatly simplifies correction and entering of these files. The subcategory information is written in abbreviated form to reduce memory requirements.

Key Parameters

Table 2 lists the major parameters used in the program. As far as possible the names have been carried through from one routine to another to simplify the debugging process.

Modifying The Program

This program has been structured to enable you to modify easily the input and output to suit your special needs.

Table 1. Record Structure For LIBREC-120.

Record Number	Byte	Contents
0	0-As Required	NR, the number of book records contained in the file on this disk.
1-NR	0-39	Book title. Forty characters are retained. Blanks are inserted if title length is less than 40 characters.
	40	Return
	41-80	Book author(s). Forty characters are retained. Slashes (/) separate individual names on multi-author books. Blanks are added as required to fill out to 40 characters.
	81	Return
	82	Book type; N=nonfiction, F=fiction.
	83	Return
	84-86	Catalog number. Nonfiction books are filed under Dewey Decimal System, fiction books by a three-digit number based on type.
	87	Return
	88-90	Shelf location, three-character code.
	91	Return
	92	Book height, S, N, T.
	93	Return
	94	Number of authors.
	95	Return
	96	Borrow status, 0 = on shelf, 1 = out on loan.
	97	Return
	98-112	Borrower's name, last/first name. Fifteen characters, blanks added as required.
	113	Return
	114-119	Unused; saved for future use by individual programmer.

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Subroutines are used extensively for searching, data entry checking, and result presentation, localizing the areas that must be examined if changes are to be made. Space has been left on the book record file so that you may easily add other information that you desire to file, such as publication or acquisition date for each book.

With the advent of megabyte capacity hard disks for use with personal computers such as the Apple the necessity of using multiple disks for book data storage will disappear. This program will then be suitable for use with much larger libraries.

Acknowledgments

I would like to thank the reference librarians at the Monroeville, PA Public Library for their help in obtaining the listing of the Dewey Decimal System classifications and in teaching me some of the particulars of cataloguing books. ☐

Table 2.

Key Parameters Used In Library Catalog Program

AU$, AU$( )	Author last name, array for storing author's name between WRITE commands
BC	Counter for books. Calls for disk WRITE command when BC=DC
BL$	String of 40 blanks, used to pad title and author strings
BN$	Book borrower name, 15 characters, Last/First Name
BS	Borrow status, 0 = book on shelf; 1 = out on loan
C$	Category digit of catalog number
CN$, CN$( )	Catalog number, array for catalog number; three characters
DC	Limit on number of cycles between WRITE commands in Enter. Set at 5 in line 80.
DD	Counter for disks containing book data
DN	Number of disks containing book data
DV	Division digit of catalog number
ER	Error code, found in PEEK(222)
FC	Catalog number for fiction books
HI	Flag for success on search, 0 = no success; 1 = success
LC$, LC$( )	Location ID code, array for storing ID codes
MT	Flag for error routine, 0 if error due to no book data on file, 1 if disk full or other error
NA, NA( )	Number of authors of book entered. Limited to five for single book, array to store NA
NS	Number of shelves on file in shelf directory
RN	Number of records on a data disk. RN is stored in the zeroth record of LIBREC-120.
S$	Subcategory digit of catalog number
SC$	Array containing all catalog classification data
SZ$, SZ$( )	Book height, array for storing book height
TL$, TL$( )	Book title, array for storing TL$
TP$, TP$( )	Book type, fiction or nonfiction, array for storing TP$
WF	Flag for book fit on shelf; 0 = book will fit, 1 = book too tall for shelf

Additional Parameters Used In Search

A$	On author search, used to check for name divider (/) or end of last author's name (blank)
AA$	On author search, author's name
AH$	On author search, author's name as read from LIBREC-120 file
AM$( )	Array of author's names from LIBREC-120 file, for books with multiple authors
AN	Counter for number of authors found on LIBREC-120 file for books with multiple authors
MOD	Flag for MODIFY use of Search routine, 0 = title, author, subject search; 1 = modify record
NM$( )	Array to store names of authors in search list
NN	Number of authors in search list
SP	Parameter used to pad the search catalog number to three digits, if necessary
TE	Flag, 0 = no book found; 1 = book found

Additional Parameters Used In Bookshelf

DC$( )	Array for storing free-form description of shelf locations.

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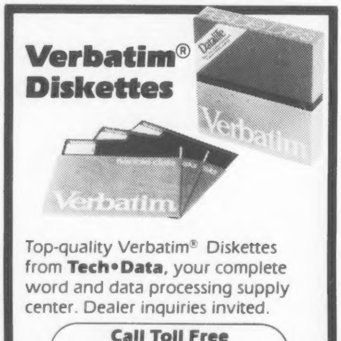

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80  PRINT D$;"CLOSE"
100  DATA  "THE ARTS","PHILOSOPHY & THEORY","MISC","DICTIONARIES & ENCLYCL
     OS","SPECIAL TOPICS OF GEN APP"
110  DATA  "SERIAL PUBS","ORGANIZATIONS & MGMT","STUDY & TEACHING","GALLER
     IES- MUSEUMS- ART COLLECT","HISTORICAL & GEOG TREATMENT"
120  DATA  "CIVIC & LANDSCAPE ART","AREA PLANNING (CIVIC ART)","LANDSCAPE
     DESIGN","LANDSCAPE DES OF TRAFFICWAYS","WATER FEATURES"
130  DATA  "WOODY PLANTS","HERBACEOUS PLANTS","STRUCTURES","LANDSCAPE DES
     OF CEMETARIES","NATURAL LANDSCAPES"
140  DATA  "ARCHITECTURE","ARCH CONSTRUCTION","ANCIENT & ORIENTAL ARCH","M
     EDIEVAL ARCH","MODERN ARCH"
150  DATA  "PUBLIC STRUCTURES","BUILDINGS FOR RELIG PURPOSES","BUILDINGS F
     OR ED","RESIDENTIAL BLDGS","DESIGN & DECORATION"
160  DATA  "PLASTIC ARTS- SCULPTURE","PROCESSES & REPRESENTATIONS","NONLIT
     ERATE- ANCIENT- ORIENTAL","GREEK- ETRUSCAN- ROMAN","MEDIEVAL SCULPTUR
     E"
170  DATA  "MODERN SCULPTURE","CARVING & CARVINGS","NUMISMATICS & SIGILLOG
     RAPHY","CERAMIC ARTS","ART METALWORK"
180  DATA  "DRAWING- DECORATIVE- MINOR ARTS","DRAWING & DRAWINGS","PERSPEC
     TIVE","DRWG & DRWG BY SUBJ","* "
190  DATA  "DECORATIVE & MINOR ARTS","TEXTILE ARTS & HANDICRAFTS","INTERIO
     R DECOR","GLASS","FURNITURE & ACCESSORIES"
200  DATA  "PAINTING & PAINTINGS","PROCESSES & FORMS","COLOR","ABSTRACTION
     S- SYMBOLISM- LEGEND","SUBJECTS OF EVERYDAY LIFE"
210  DATA  "RELIGION & RELIGIOUS SYMBOLISM","HISTORICAL EVENTS","HUMAN FIG
     URES & THEIR PARTS","OTHER SUBJECTS","HISTORICAL & GEOG TREATMENT"
220  DATA  "GRAPHIC ARTS- PRINTS","RELIEF PROCESSES","* ","LITHOGRAPHIC PR
     OCESSES","CHROMOLITHOGRAPHY & SERIGRAPHY"
230  DATA  "METAL ENGRAVING","MEZZOTNTG & AQUATNTG PROC","ETCHING & DRYPOI
     NT","* ","PRINTS"
240  DATA  "PHOTOGRAPHY & PHOTOGRAPHS","APPARATUS- EQUIP- MATLS","METALLIC
      SALT PROCESSES","PIGMENT PROCESSES OF PRINTING","HOLOGRAPHY"
250  DATA  "* ","* ","* ","SPECIFIC FIELDS OF PHOTOG","PHOTOGRAPHS"
260  DATA  "MUSIC","GENERAL PRINCIPLES","DRAMATIC MUSIC","SACRED MUSIC","V
     OICE & VOCAL MUSIC"
270  DATA  "INST ENSEMBLES & MUSIC","KEYBD INST & MUSIC","STRING INST & MU
     SIC","WIND INST & MUSIC","PERCUSSION- MECH- ELECT"
280  DATA  "RECREATIONAL & PERF ARTS","PUBLIC PERFS","THEATER (STAGE)","IN
     DOOR GAMES & AMUSEMENTS","INDOOR GAMES OF SKILL"
290  DATA  "GAMES OF CHANCE","ATHLETIC & OUTDOOR SPORTS & GAMES","AQUATIC
     & AIR SPORTS","EQUESTRIAN SPORTS & ANIMAL RACING","FISHING- HUNTING-
     SHOOTING"
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```
10  REM  PROGRAM TO CREATE SC SEQ LIST 8
20  DIM SC$(100)
30 D$ =  CHR$ (4)
40  FOR I = 1 TO 100: READ SC$(I): NEXT
50  PRINT D$;"OPEN SC SEQ LIST 8"
60  PRINT D$;"WRITE SC SEQ LIST 8"
70  FOR I = 1 TO 100: PRINT SC$(I): NEXT
80  PRINT D$;"CLOSE"
100  DATA  "LITERATURE (BELLES-LETTRES)","PHILOSOPHY & THEORY","MISC ABOUT
      LIT","DICTIONARIES & ENCLYCLOS","* "
110  DATA  "SERIAL PUBS","ORGANIZATONS","STUDY & TEACHING","RHETORIC & COL
     LECTIONS","HISTORY- DESCRIPTION- APPRAISAL"
120  DATA  "AMERICAN LIT IN ENG","POETRY","DRAMA","FICTION","ESSAYS"
130  DATA  "SPEECHES","LETTERS","SATIRE & HUMOR","MISC WRITINGS","* "
140  DATA  "ENG & ANGLO-SAXON LITS","ENG POETRY","ENG DRAMA","ENG FICTION"
     ,"ENG ESSAYS"
150  DATA  "ENG SPEECHES","ENG LETTERS","ENG SATIRE & HUMOR","ENG MISC WRI
     TINGS","ANGLO-SAXON (OLD ENG)"
160  DATA  "LITS OF GERMANIC LANGS","GER POETRY","GER DRAMA","GER FICTION"
     ,"GER ESSAYS"
170  DATA  "GER SPEECHES","GER LETTERS","GER SATIRE & HUMOR","GER MISC WRI
     TINGS","OTHER GERMAINC LITS"
180  DATA  "LITS OF ROMANCE LANGS","FR POETRY","FR DRAMA","FR FICTION","FR
      ESSAYS"
190  DATA  "FR SPEECHES","FR LETTERS","FR SATIRE & HUMOR","FR MISC WRITING
     S","PROVENCAL & CATALAN"
200  DATA  "ITAL- ROMANIAN- RHAETO-ROMANIC","ITAL POETRY","ITAL DRAMA","IT
     AL FICTION","ITAL ESSAYS"
210  DATA  "ITAL SPEECHES","ITAL LETTERS","ITAL SATIRE & HUMOR","ITAL MISC
      WRITINGS","ROMANIAN & RHAETO-ROMANIC"
220  DATA  "SPAN & PORT LITS","SP POETRY","SP DRAMA","SP FICTION","SP ESSA
     YS"
230  DATA  "SP SPEECHES","SP LETTERS","SP SATIRE & HUMOR","SP MISC WRITING
     S ","PORTUGUESE"
240  DATA  "ITALIC LIT- LATIN","LATIN POETRY","LATIN DRAMATIC POETRY & DRA
     MA","LATIN EPIC POETRY & FICTION","LATIN LYRIC POETRY"
250  DATA  "LATIN SPEECHES","LATIN LETTERS","LATIN SATIRE & HUMOR","LATIN
     MISC WRITINGS","OTHER ITALIC LANGS"
260  DATA  "HELLENIC LITS- GREEK","CLASSICAL GREEK POETRY","CLASSICAL GREE
     K DRAMA","CL GK EPIC POETRY","CL GK LYRIC POETRY"
270  DATA  "CL GK SPEECHES","CL GK LETTERS","CL GK SATIRE & HUMOR","CL GK
     MISC WRITINGS","MODERN GREEK"
280  DATA  "LITS OF OTHER LANGS","E INDO-EUR & CELTIC","AFRO-ASIATIC (HAMI
     TO-SEMITIC)","HAMITIC & CHAD LITS","URAL-ALTAIC-PALEOSIBRN-DRAVIDIAN"

290  DATA  "SINO-TIBETAN & OTHER ASIAN","AFRICAN LITS","N AMER NATIVE LITS
     ","S AMER NATIVE LITS","OTHER LITS"
```

```
10  REM   PROGRAM TO CREATE SC SEQ LIST 9
20  DIM SC$(100)
30 D$ =  CHR$ (4)
40  FOR I = 1 TO 100: READ SC$(I): NEXT
50  PRINT D$;"OPEN SC SEQ LIST 9"
60  PRINT D$;"WRITE SC SEQ LIST 9"
70  FOR I = 1 TO 100: PRINT SC$(I): NEXT
80  PRINT D$;"CLOSE"
100  DATA  "GENERAL GEOG & HIST","PHIL OF GEN HIST","MISC OF GEN HISTORY",
     "DICTIONARIES OF GEN HIST","COLLECTED ACCOUNTS OF EVENTS"
110  DATA  "SERIALS ON GEN HIST","ORGANIZATIONS OF GEN HIST","STUDY & TEAC
     HING OF GEN HIST","* ","GENERAL WORLD HISTORY"
120  DATA  "GENERAL GEOG- TRAVEL","HISTORICAL GEOG","GRAPHIC REPRESENTATIO
     NS OF EARTH","GEOG OF ANCIENT WORLD","EUROPE"
130  DATA  "ASIA","AFRICA","N AMERICA","S AMERICA","OTHER AREAS & WORLDS"
140  DATA  "GEN BIOGRAPHY & GENEALOGY ","BIOGRAPHY A-C ","BIOGRAPHY D-F ",
     "BIOGRAPHY G-I ","BIOGRAPHY J-L "
150  DATA  "BIOGRAPHY M-O ","BIOGRAPHY P-S ","BIOGRAPHY T-V ","BIOGRAPHY W
     -Z ","GENEALOGY- NAMES-INSIGNIA"
160  DATA  "GEN HIST OF ANCIENT WORLD","CHINA","EGYPT","PALESTINE","INDIA"

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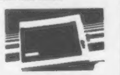

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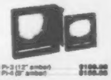

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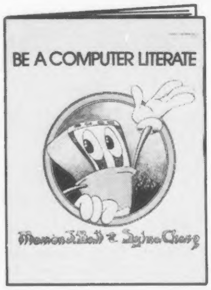

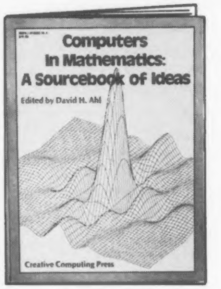

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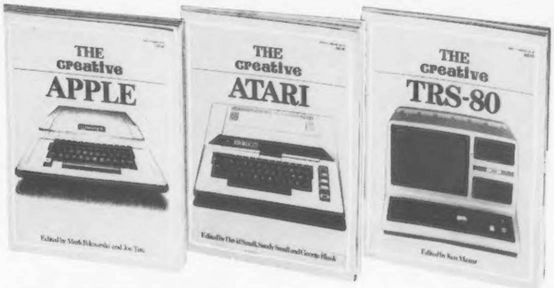

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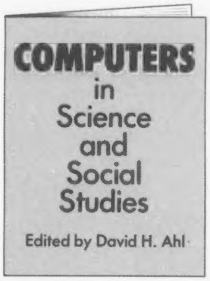

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Part Nine: Wrap Up

The Graph Paper

David Lubar

Up to now, we've been covering graphics concepts in a bit of a vacuum, looking at specific areas as independent entities. This month, in what will be the last of the series, we'll be concerned with integrating these concepts into actual games. A lot of what follows falls into the theoretical, and I should stress that none of this is gospel. You should always be on the lookout for new approaches and better techniques.

The Illusion of Simultaneity

Those used to programming in Basic wonder how arcade games can cause so many objects to move at the same time. The answer is that this is an illusion. In the Apple, there are no simultaneous events. Everything happens in sequence. You put a byte on the screen, then another, and so on. Thanks to the speed of machine language, a long series of independent events can appear to happen at the same time. The trick is to organize these events in such a way that this illusion is maintained. If you are animating several objects, they should all be moved with the same section of code. One way to do this is to keep an ordered list of all necessary information for each item.

Let's say your program requires the following information about each object: old X coordinate, old Y coordinate, new X, new Y, X velocity, Y velocity, shape number, and some sort of status byte (more about that later). If these eight parameters are stored sequentially in RAM for each object, all animation can be handled in one loop. The X register can be used to index into the list. The easiest way to do this is to separate each set of entries by some power of 2. In this case, eight is sufficient. If there were nine or ten items in the list, the separation would be 16 bytes. Suppose, in our example, that the list starts at $8000. Old X coordinate of the first item would be stored at $8000, old X for the second item would be at $8008, the third would be at $8010, and so on. Now, if a variable is used to keep track of the number of items in the list, and if the separation is a power of 2, the variable can be shifted to provide an index into the list. An example can be found in Listing 1.

The number of items in each entry will be determined by the program. Some programs require only simple parameters. Others can get fairly complex. Let's look at some of these parameters.

Move it

The smallest unit an object can be moved is a single pixel. In simple programs, all locations can be treated as integers. The change in X and Y location (DX and DY) can be held in one byte each. One trick is to exploit the cyclic nature of bytes and always use addition. To move right one pixel, a DX of $01 is used. When moving left, DX is $FF (adding $FF is the same as subtracting $01). This is simpler than having separate routines for adding or subtracting DX and DY. Also, it makes changes of direction easy to calculate. To make an object bounce, you just subtract DX or DY from $00. The result becomes the new DX or DY ($00 - $01 = $ff and $00 -$FF = $01). This works for any value of DX and DY.

While integers are fine for simple motion, they have some limitations. If the change becomes too great, the object jumps rather than moving smoothly. And curved paths are difficult to produce. The answer is to use fractional values. While an object can't be moved a half or fourth of a pixel, this fractional portion can be kept track of. Imagine an object has a DX of one and a DY of one half. Every time it is plotted, it will move one pixel to the right. Every second time, it will move up one pixel. If both DX and DY have a value of one half, the object will move on a diagonal, but at half speed. Such things as gravity and curving paths are easily done using fractional values. I believe this is called "fixed point arithmetic." Whatever, let's take a close look at it.

Each parameter requires two bytes, one for the fraction and one for the integer portion. As before, all calculations can be done with addition. The trick is remembering that the fraction is a binary fraction. So one half would be $80 (.10000000 in binary), one fourth would be $40, and so on. As with integer values, direction can be flipped by subtracting the values from $00. The only constraint is that the subtraction must be treated as a two-byte operation. First the carry is set and the fraction is subtracted from $00. The result is the new fractional portion. Next, without touching the carry, the integer portion is subtracted from $00 and the result saved as the new integer portion. For instance (calling the integer portion DX and the fractional portion DXF), suppose DX is $01 and DXF is $80. The object would move right at a rate of one and a half pixels per plot (actually, it would alternate between moving one pixel and mov-

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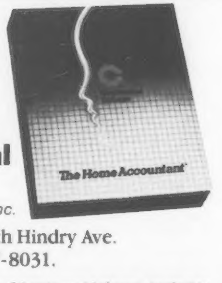

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ing two pixels, producing an average rate of one and a half). If you wanted to make the object bounce back to the left, you would subtract DXF from $00, getting $80, and DX from $00, getting (with the borrow from the first subtraction) $fe. The next DX of $FE and DXF of $80 would equal a movement to the left at a rate of one and a half pixels per plot.

The ability to work with fractional motion adds a great deal of control to programs. If you add a value to the fractional portion, you produce acceleration. One object can be made to chase another. If the target is to the right of the object, add something to DXF. If the target is to the left, subtract something from DXF. The amount added or subtracted determines how accurately and quickly one object tracks another. Listing 2 shows some common calculations done with fractional values.

Another handy parameter is a status byte. Not all objects will be treated the same at all times. Something might be disappearing, something else might be appearing, while a third object is undergoing a change such as an explosion. By using a byte as a flag for these conditions, one display loop can handle everything. Let's say you want to remove an object from the screen. The display loop would ordinarily calculate a new location, erase the old position, then draw the new position. But each portion first checks the status byte. If the byte contains a certain value, that portion is skipped. In this example, the status byte would indicate that the drawing portion could be skipped. Thus, the object would be erased but not replotted (the calculation of its new location could also be skipped).

Another independent event that appears simultaneous is sound. Without it, games would be very dull.

```
* EXAMPLE OF USING
* A DISPLAY FILE
*
* VARIABLES FOR THE FILE
*
OLDX     EQU  $8000
OLDY     EQU  $8001
NEWX     EQU  $8002
NEWY     EQU  $8003
DX       EQU  $8004
DY       EQU  $8005
SHAPE    EQU  $8006
STATUS   EQU  $8007
*
OBJECTS  EQU  $F0          ;HOLDS NUMBER OF OBJECTS -1
TEMP     EQU  $F1
*
* SAMPLE DISPLAY LOOPS FOLLOWS.
* THIS IS NOT A WORKING PROGRAM,
* ONLY AN EXAMPLE.
*
         LDA  OBJECTS      ;GET NUMBER OF OBJECTS
         STA  TEMP
LOOP     LDA  TEMP         ;MULTIPLY BY EIGHT
         ASL               ;TO GET PROPER INDEX VALUE
         ASL
         ASL
         TAX
* CALCULATE NEW LOCATION
         LDA  OLDX,X
         CLC
         ADC  DX,X
         STA  NEWX,X
         LDA  OLDY,X
         CLC
         ADC  DY,X
         STA  NEWY,X
*
* ERASING, PLOTTING, ETC WOULD
* FOLLOW. ALL ACTIONS COMMON TO
* ALL ITEMS IN THE LIST WOULD BE
* HANDLED WITHIN THE LOOP
*
         DEC  OBJECTS      ;DONE?
         BPL  LOOP         ;NO, GO BACK FOR MORE
* NOTE: IF OBJECTS HAS A STARTING
* VALUE GREATER THAN $80, BPL
* CANNOT BE USED
```

Listing 1.

Buzz, Click

The Apple has a rather limited sound capability, though you couldn't guess that from the great sound effects produced by some programs. Basically, all that can be produced is a click from the speaker. But by playing with the rate at which the speaker clicks, you can get a wide variety of sounds. The trick is to integrate the sound within a program. If sound is handled as a separate event, everything will stop. This is fine for music on a title page, but not desirable in the middle of a game. Thus, the code for producing sound must work in conjunction with the rest of the program.

For instance, let's say you have a ball bouncing on the screen, and want a sound whenever the ball hits a wall. The wrong way would be to go to a subroutine that produced the whole sound. The object is to integrate the sound. One way is to find some loop and insert the sound routine there. Most plotting routines occur in a loop. Let's say you add some code to the plotting routine. This code, after putting each byte on the screen, checks a flag. If the flag is set, it strobes the speaker. If not, it skips that code. When the ball bounces, you set the flag. The result will be some sound on every collision. The speaker is strobed at location $C030. Every access to that location causes a click. A load (such as LDA $C030) produces one click. A store actually accesses the location twice, thus producing two clicks. By experimenting with speaker strobes in various loops of code, you can produce many sounds, but this is a trial-and-error approach. Another method is to have a subroutine that is called one or more times during each pass through the program. This routine, using values contained in specific variables and flags, would access the speaker one or more times (depending on values in the variables), or it might skip right to the RTS (again depending on the variables and flags). This subroutine can actually contain a short loop or perhaps ten or twenty iterations without noticeably slowing down a program. By controlling frequency (number of times per second that the event occurs) and volume (number of clicks in each event) your game can come alive with sound. The best way to learn is to experiment.

It's time to take a look at overall program structure, followed by some thoughts on game design.

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```
* EXAMPLES OF USING
* FRACTIONAL DX AND DY
*
XLOC      EQU  $F0         ;X COORDINATE
XLOCF     EQU  $F1         ;FRACTIONAL COORDINATE
DX        EQU  $F2         ;INTEGER PORTION OF MOVEMENT
DXF       EQU  $F3         ;FRACTIONAL PORTION
*
* EXAMPLE OF UPDATING A LOCATION
*
          LDA  XLOCF       ;ADD FRACTIONS FIRST
          CLC              ;MUST BE CLEARED FOR FIRST ADD
          ADC  DXF
          STA  XLOCF       ;UPDATE FRACTION
          LDA  XLOC
          ADC  DX          ;LEAVE CARRY ALONE
          STA  XLOC
*
* CALCULATION FOR CHANGING THE
* SIGN OF DX (BOUNCING).
*
          LDA  #$00
          SEC              ;CARRY SET FOR FIRST SUBTRACT
          SBC  DXF
          STA  DXF
          LDA  #$00
          SBC  DX          ;CARRY LEFT ALONE HERE
          STA  DX
*
* ACCELERATION AND DECELERATION
*
          LDA  DXF
          CLC
          ADC  #$20        ;CHANGE BY ONE EIGHTH
          STA  DXF
          LDA  DX
          ADC  #$00
          STA  DX
*
```

Listing 2.

One Big Loop

Aside from title page and other frills, a game can be thought of as an infinite loop of code. Once the initial conditions have been set, the code just keeps repeating. Some events are skipped, others may happen just once, but the overall structure is one big loop. The key is organizing the units within the loop. As mentioned, the goal is to take individual events and produce the illusion of simultaneity. The more efficient your code, the better the illusion. A rough flow chart can help in setting up the program. It needn't be an immaculate work of art. Just a rough sketch with boxes and arrows is a great help. This will show the logical sequence of events, and make the task of actual coding simpler. Many programs start by reading the controllers, then do the plotting, followed by handling any special actions required by the events on the screen. If you are reading a joystick or two paddles, place the reads at separate areas of the code (if you read two paddles without enough intervening delay, the first value will affect the second).

Events that happen frequently are usually placed in line. Rare events can be placed in subroutines. There are no concrete rules here. Each program has its own requirements. But you'll find that the common tie throughout all good programs is logical structure. *Sneakers, Raster Blaster,* and *Serpentine* contain vastly different code, but if you mapped the structure of these or other games, you'd find elegant, logical organization, breaking a complex whole into simple units. When writing a large program, tackle the work one unit at a time. This is where the flow chart really helps. Each group of blocks with one entry at the top and one exit at the bottom can be thought of as a unit. By programming one unit at a time, and debugging it, you'll end up with a tight, efficient program.

While whole books have been written on the subject of program structure, the best way to learn is to write programs.

Enough probably can and has been said about game design, so I won't dwell too long on the subject. But I can't resist a few words. Apple games have become very sophisticated. Certain requirements are almost mandatory in any new arcade game that hopes to make it to market. For starters, the graphics must be clean. There is also a trend these days toward cuteness. This may or may not last, but any unique or cute touch in your graphics is probably an advantage, though such things must make sense within the context of the program. All possible controller options should be allowed. If you are using a keyboard, the player should be able to define the keys. For a joystick, the player should be able to switch the X and Y axes (just in case his joystick and yours differ).

Games can't be static. There has to be some increase in difficulty or some new level to reach. In other words, a game must have depth. A game must contain learnable skills. The average player should be able to notice an improvement in his performance—a reward for repeated play.

The best way to assure that your game will be fun is to have others play test it. No programmer can be totally objective about his creation. And by the time you have finished the game, you will be so good at playing it that you won't be able to balance the difficulty fairly. It is not uncommon for a programmer to make his game harder and harder, not realizing that the average player will be blown away by the result. On the other hand, don't assume that no one will top your own performance. Add some levels or difficulty above the point you can reach. It is almost inevitable that someone will be better at the game than you.

Farewell

I could ramble on, but enough has been said here, and one person can't hope to cover everything. Fortunately, there are more and more graphics articles appearing. The word is getting out. I hope I've filled in some of the gaps that existed, and shown that there is no real mystery to Apple graphics.

Before signing off, I want to thank those who, directly or indirectly, had a part in this. First, special thanks to Bob Bishop, both for taking the time to give me a push in the right direction, and for showing all of us, from the start, that there is magic in the Apple. Thanks to Mark Pelczarski for many things. And thanks to all those who shared ideas or answered questions. Such a list, though far from complete, must include Mark Turmell, Dan Thompson, Hunter Hancock, Ernie Brock, Bill Budge, and Frank Covitz. Finally, thanks to all of you who've shown interest in this series and taken the time to send questions and suggestions. It's been fun. □

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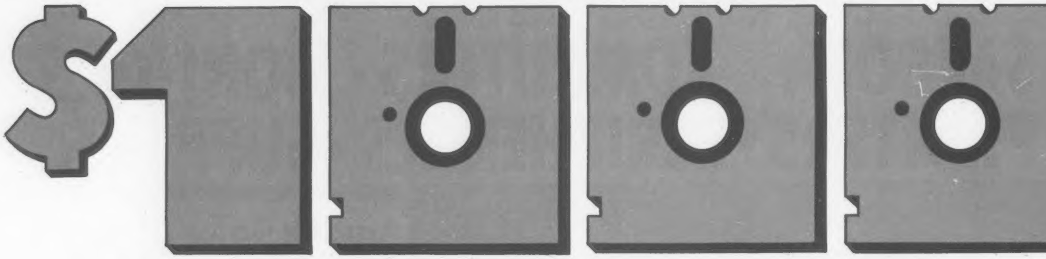

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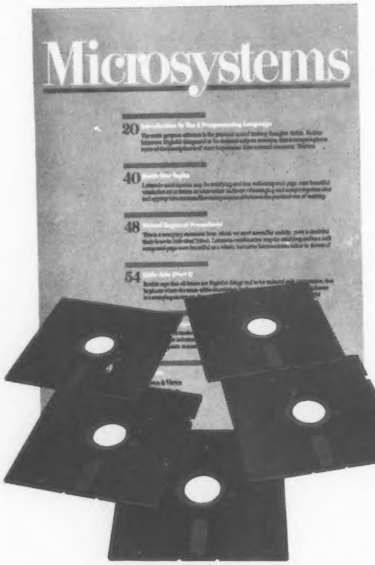

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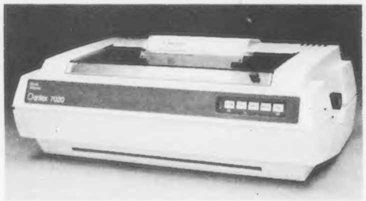

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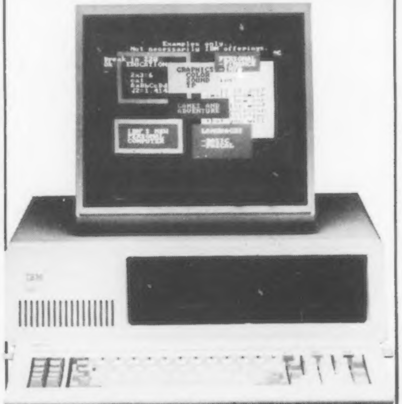

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play. Taxan RGBvision I retails for $399 and RGBvision II, $599.

TSK Electronics Corporation, 1524 Highland Ave., Duarte, CA 91010. (213) 357-9991.

CIRCLE 432 ON READER SERVICE CARD

SYSTEMS SOFTWARE

SYSTEMS

The **Infosoft C compiler** includes a preprocessor that implements conditional compilation, file inclusion, and macro expansion. The run-time library includes an I/O redirection utility. The package requires 48K and any of the following operating systems: CP/M I/OS, UNI/OS, Multi/OS, CP/M, CDOS. Infosoft Systems, Inc., 25 Sylvan Rd. South, Westport, CT 06880.

CIRCLE 433 ON READER SERVICE CARD

LANGUAGES

APL*Plus/80 is the TRS-80 implementation of a version of Ken Iverson's APL language. Special features include formatting error-handling, shared filing system, workspace management, and interface to nonAPL data.

STSC, Inc., 2115 East Jefferson St., Rockville, MD 20852.

CIRCLE 434 ON READER SERVICE CARD

APPLICATIONS SOFTWARE

GAMES AND RECREATIONAL

Walls and Bridges is a new arcade game for the TI-99/4A computer, featuring hi-res graphics. Each player must build a wall, trying to avoid collision, while forcing the other player into collision. Obstacles like quicksand, trees, and castles, add to the challenge. The game requires joysticks, and is available on tape cassette. $20. TImagination, Box 2805, Fairfield, CA 94533.

CIRCLE 435 ON READER SERVICE CARD

EDUCATIONAL

Krell Software has released **Ben**, the first in a series of programs designed to learn from their environment. Accompanying documentation helps users create experimental artificial intelligence programs; the program language allows for the synthesis of "memory structures." Available for the Apple, Commodore, Franklin, Radio Shack, and IBM computer. $79.95. Krell Software 1320 Stony Brook Rd., Stony Brook, NY 11790. (516) 751-5139.

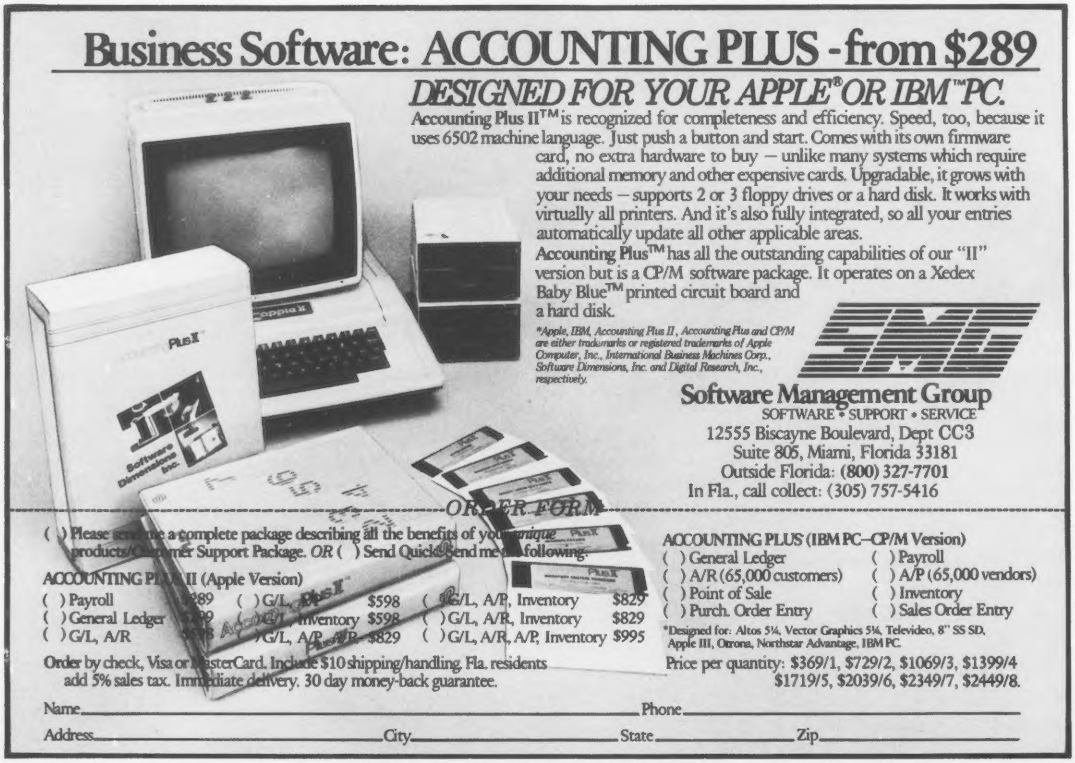
CIRCLE 436 ON READER SERVICE CARD

SRA has announced **Discovering Basic**, a courseware program that introduces the user to the Basic language. The program is designed to teach fundamental programming concepts, and includes examples of colorful screen graphics. The package consists of a workbook, a disk and an instructor's guide. It's for the Apple II 48K with Applesoft and disk drive. Science Research Associates, 155 North Wacker Dr., Chicago, IL 60606. (312) 984-7053.

CIRCLE 437 ON READER SERVICE CARD

Nursery Time is an open-ended electronic book simulated on a double-sided disk using graphics and music. The package is recommended for children aged from 3-9, with an Apple II Plus and disk drive. The program and accompanying 13-page booklet cost $29.95. Merry Bee Communications, 815 Crest Dr., Omaha, NE 68046.

CIRCLE 438 ON READER SERVICE CARD



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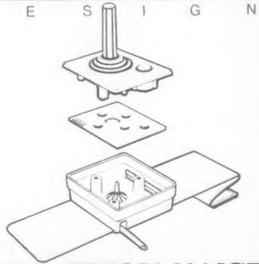

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New Products, continued...

Microsoft has made its **muMath/muSimp** package available for the IBM Personal Computer. The advanced mathematics package has been available for Apple, TRS-80, and CP/M-80 computer systems for some time. The muMath package allows complex mathematical functions, such as integration, differentiation, factorials, and base conversion to be straightforwardly handled. The language muSimp allows tailor-made applications of muMath. the IBM PC version is priced at $300. Microsoft, 10700 Northrup Way, Bellevue, WA 98004. (206) 828-8080.

CIRCLE 439 ON READER SERVICE CARD

BUSINESS

The Software Fitness Program is a set of seven interactive financial accounting packages which include Sales Order Processing, Accounts Receivable, Inventory, General Ledger, Accounts Payable, Payroll, and Job Costing. **The Coach** is an instruction generator that allows creation of self-paced, on-line learning programs for user training of computer applications. These applications are all written in Business Basic and Cobol for use on CP/M systems with 4K and two disk drives. Open Systems, Inc., Suite 409-430 Oak Grove, Minneapolis, MN 55403.

CIRCLE 440 ON READER SERVICE CARD

WORD PROCESSING

The **Personal Secretary** is a word processing program that includes a lower case adapter. The package also includes a database and a mailing list merger. The program costs $99.95 and requires an Apple II with 48K and a disk drive. Sof/Sys Inc., 4306 Upton Ave. South, Minneapolis, MN 55410.

CIRCLE 441 ON READER SERVICE CARD

PERSONAL

Fast Figure is a spreadsheet program that computes financial functions including net present value, internal rate of return, compound growth rate, etc. It costs $110 and requires 46K and either CP/M or North Star DOS. **Market Time** helps investors spot market turning points. It includes a database of DJIA, CBOE, and other Wall Street indices. It costs $70 and requires 34K and either CP/M or North Star DOS. **High Yield** measures the performance of investments made. It can sum the results of investments, project prices, and perform what-if analysis. It costs $70 and requires 38K and either CP/M or North Star DOS. Hourglass Systems, P.O. Box 312, Glen Ellyn, IL 60137.

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Pearformance Measurement System is a set of VisiCalc templates that measure the rate of return of investment portfolios. The central feature is the calculation of internal rate of return. Pearformance is priced at $100 and requires an Apple II with 48K and VisiCalc. Pear Systems Corp., 27 Briar Brae Rd., Stamford, CT 06903.

CIRCLE 443 ON READER SERVICE CARD

Air Navigation Trainer is a real-time simulation of air navigation. A high resolution display illustrates airspeed, heading, and many other effects. The program sells for $40 and requires an Apple II with disk drive, 48K, and Applesoft. Space-Time Associates, 20-39 Country Club Dr., Manchester, NH 03102.

CIRCLE 444 ON READER SERVICE CARD

The **Investor's Toolkit** is a collection of more than 30 programs available separately or in preconfigured packages. Functions include Fibonacci squares, MLR lines, price channels, trend lines, and trading system optimization. Prices start at $39.95. A demonstration disk can be bought for $5. All programs require an Apple II with a disk drive. Microware, 222 S. Riverside Pl., Chicago, IL 60606.

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UTILITIES AND MISCELLANEOUS

Colortext is a high-resolution text driver which displays a variety of character fonts and graphics on the screen simultaneously. Special features include nondestructive overwrite, variable scrolling speed, a break key lock-up option, and a character shape editor. The program disk costs $79.80 and requires a TRS-80 Color Computer with 32K and a disk drive. Bertamax, Inc., 101 Nickerson, Suite 202, Seattle, WA 98109.

CIRCLE 446 ON READER SERVICE CARD

Plotpak, **Strpak**, and **Mathlib** are designed for engineering and scientific users. Plotpak is a complete plotting library. Strpak is a collection of 135 subroutines for string and character processing among other things. Mathlib performs a variety of mathematical, engineering, and scientific computations. The three packages may be purchased together for $975, or separately. Individual prices are: Plotpak, $365; Strpak, $275; Mathlib, $365. Sea Data Corporation, One Bridge St., Newton, MA 02185. (617) 255-8190.

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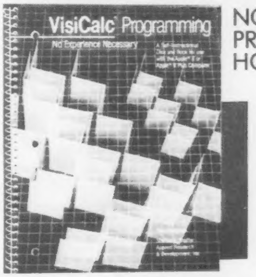

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CIRCLE 289 ON READER SERVICE CARD

e cart...apple cart...apple

Chris Adams

Recently, games have started to include speech. It certainly livens up any program, and the best part about speech is that it is truly easy to do. Listing 1 is a routine that both digitizes and replays voice without any extra hardware. It is less than 128 bytes long.

I think I have succeeded in making a short yet flexible and easy to use program. So please type it in, use it, and enjoy speech in your programs.

How It Is Done

The program digitizes voice through the cassette port on the back of the Apple. You first record the word, sound, or message that you want digitized on a cassette and then play it into the cassette IN port while running the recording routine.

The program checks the status of the signal and records it in memory. Later, when you execute the play routine, the signal stored in memory is output through the internal speaker.

Using Voice In Your Program

This voice routine was designed to be easy for the beginner to use while offering significant power for the ambitious. Therefore, I have included an assembler as well as a Basic listing.

The Basic listing is in the form of data to be POKEd in memory to form a machine language program. To use it through Basic, just type in Listing 1, being careful not to make any errors. Once entered, it can be run. The last few lines of the program do a simple sum check for obvious data errors (it is possible that it won't catch all mistakes). If it passes the check sum, Voice Maker should be in memory. Before trying it, save the Basic program, and save the machine language program by typing BSAVE VOICE,A$300,L$84

Now comes the fun part. Record the message you want the Apple to digitize on tape. Actually the cassette recorder you use will make a tremendous difference in how the voice sounds. What you need is not the most expensive cassette recorder but a recorder designed for use with a computer. Of the recorders I tested, the Radio Shack CTR-80 produced the best results.

The message should start with a count down such as "3...2...1...0...this is my message." This is so you will know how to start the digitizing process.

Before you can digitize, you must set some pointers in memory for Voice Maker. The pointers indicate where to put the data in memory, how long the recording is to be, and the speed of signal samples. The speed factor is part of a delay loop. The lower the speed factor, the clearer the voice will be at playback but at the expense of memory used for the same length of message.

The speed can be POKEd at location 251 and should be in the range of 1 to 20, one being the most accurate.

For initial experimentation, use a speed factor of one. Then when you want to start using several words in a program, use a higher delay such as 10 to spare memory. The memory pointers are stored at 06 and 07. The LSB is POKEd at 6 and the MSB at 7. The LSB and MSB are found with this formula:

MSB=INT (ADDRESS/256)
:LSB=ADDRESS-(MSB*256)

The next important location is the length marker. The length must be a product of 256 and is derived by adding the number of 256-byte segments to the MSB at location 7. The value derived with this method should be POKEd at location 252. The amount of memory used determines the length of the recording.

As a sample, record the message "3...2...1...0...I'm an Apple, what are you?" Put the start of the data at 24576 by POKEing memory locations 6 and 7 with the LSB and MSB:

MSB=INT (24576/256) :LSB=
24576-(MSB*256)

POKE 6,LSB: POKE 7,MSB

For this example use a speed of one and a length of 4K. That works out to be 16 segments of 256 bytes (each KB has four 256-byte segments). The value POKEd to 252 is MSB+16. Since in this case the MSB worked out to be 96, the value used is 96+16=112:

POKE 251,1 :REM SPEED
POKE 252,112 :REM LENGTH

Hook up the phone of your tape recorder to the cassette IN port in the rear of your Apple. Now as long as the Voice Maker program is properly in memory you can CALL 768. It doesn't matter if the tape has already been positioned to the beginning of the message on the tape.

Listing 1.

```
 10  FOR M = 768 TO 899: READ D:
     POKE M,D: NEXT M
100  DATA  141, 16, 192, 160, 0,
     132, 255, 173
110  DATA  96, 192, 41, 128, 197,
      255, 240, 5
120  DATA  174, 48, 192, 133, 255
     , 173, 0, 192
130  DATA  16, 237, 32, 51, 3, 17
     7, 253, 37
140  DATA  8, 174, 96, 192, 16, 2
     , 5, 250
150  DATA  145, 253, 32, 76, 3, 3
     2, 70, 3
160  DATA  76, 29, 3, 160, 0, 162
     , 1, 134
170  DATA  250, 162, 254, 134, 8,
      166, 6, 134
180  DATA  253, 166, 7, 134, 254,
      96, 166, 251
190  DATA  202, 208, 253, 96, 200
     , 208, 23, 230
200  DATA  254, 165, 254, 197, 25
     2, 208, 15, 165
210  DATA  250, 10, 176, 11, 133,
      250, 73, 255
220  DATA  133, 8, 166, 7, 134, 2
     54, 96, 104
230  DATA  104, 96, 32, 51, 3, 17
     7, 253, 37
240  DATA  250, 197, 255, 240, 3,
      174, 48, 192
250  DATA  133, 255, 32, 76, 3, 3
     2, 70, 3
260  DATA  234, 76, 109, 3
299 T = 0
300  FOR M = 768 TO 899:T = T +
     PEEK (M): NEXT
305  IF T < > 16687 THEN  PRINT
     "THERE MUST HAVE BEEN AN ERR
     OR IN THE DATA,  THE TOTAL W
     AS ";T;" AND IT SHOULD HAVE
     BEEN 16687"
```

Chris Adams, 1864 Matthews, Vancouver, B.C., Canada V6J 2T6.

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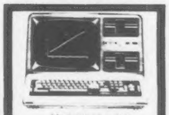

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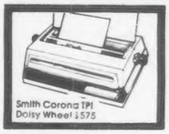

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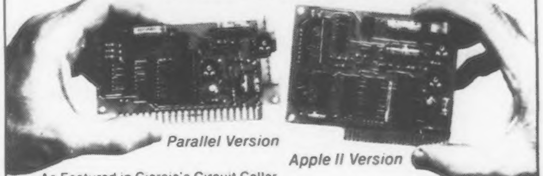

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Apple Cart, continued...

You can rewind and then play the tape to find the message. The first part of the program will put the signal input through the IN port directly to the built-in speaker without digitizing anything. The actual digitizing process isn't activated until you hit a key on the keyboard.

Until you do, you can adjust the volume and tone until the voice coming from the Apple is as you want it. If the volume is too low, there won't be any signal at all; if the volume is too high there will be a tremendous amount of static.

Once volume and tone are satisfactory, set up the tape to begin the countdown. Listen until the zero is finished, then hit any key, and the input signal will be digitized until the allotted memory is full. While digitizing, you can't hear what is going on. When the cursor returns to the screen, the recording process is over, and you can stop the cassette recorder.

Listing 2.

```
*300L

0300-   8D 10 C0    STA   $C010
0303-   A0 00       LDY   #$00
0305-   84 FF       STY   $FF
0307-   AD 60 C0    LDA   $C060
030A-   29 80       AND   #$80
030C-   C5 FF       CMP   $FF
030E-   F0 05       BEQ   $0315
0310-   AE 30 C0    LDX   $C030
0313-   85 FF       STA   $FF
0315-   AD 00 C0    LDA   $C000
0318-   10 ED       BPL   $0307
031A-   20 33 03    JSR   $0333
031D-   B1 FD       LDA   ($FD),Y
031F-   25 08       AND   $08
0321-   AE 60 C0    LDX   $C060
0324-   10 02       BPL   $0328
0326-   05 FA       ORA   $FA
0328-   91 FD       STA   ($FD),Y
032A-   20 4C 03    JSR   $034C
032D-   20 46 03    JSR   $0346
*L
0330-   4C 1D 03    JMP   $031D
0333-   A0 00       LDY   #$00
0335-   A2 01       LDX   #$01
0337-   86 FA       STX   $FA
0339-   A2 FE       LDX   #$FE
033B-   86 08       STX   $08
033D-   A6 06       LDX   $06
033F-   86 FD       STX   $FD
0341-   A6 07       LDX   $07
0343-   86 FE       STX   $FE
0345-   60          RTS
0346-   A6 FB       LDX   $FB
0348-   CA          DEX
0349-   D0 FD       BNE   $0348
034B-   60          RTS
034C-   C8          INY
034D-   D0 17       BNE   $0366
034F-   E6 FE       INC   $FE
0351-   A5 FE       LDA   $FE
0353-   C5 FC       CMP   $FC
*L

0355-   D0 0F       BNE   $0366
0357-   A5 FA       LDA   $FA
0359-   0A          ASL
035A-   B0 0B       BCS   $0367
035C-   85 FA       STA   $FA
035E-   49 FF       EOR   #$FF
0360-   85 08       STA   $08
0362-   A6 07       LDX   $07
0364-   86 FE       STX   $FE
0366-   60          RTS
0367-   68          PLA
0368-   68          PLA
0369-   60          RTS
036A-   20 33 03    JSR   $0333
036D-   B1 FD       LDA   ($FD),Y
036F-   25 FA       AND   $FA
0371-   C5 FF       CMP   $FF
0373-   F0 03       BEQ   $0378
0375-   AE 30 C0    LDX   $C030
0378-   85 FF       STA   $FF
*L

037A-   20 4C 03    JSR   $034C
037D-   20 46 03    JSR   $0346
0380-   EA          NOP
0381-   4C 6D 03    JMP   $036D
0384-   00          BRK
0385-   00          BRK
0386-   00          BRK
0387-   00          BRK
0388-   00          BRK
0389-   00          BRK
038A-   00          BRK
038B-   00          BRK
038C-   00          BRK
038D-   00          BRK
038E-   00          BRK
038F-   00          BRK
0390-   00          BRK
0391-   00          BRK
0392-   00          BRK
0393-   00          BRK
```

To hear the results, just type CALL 874. If all has gone well, you will have a talking Apple. If it didn't work, then there was a mistake either when you entered the data or during the experimental process.

In the future when you want a program to use voice just BLOAD VOICE and set up locations 6 and 7 with the address of the digitized data, put the same value as when you recorded into 251, and 252 should represent the length relative to the position in memory. If you want more than one recording to be used in one program, load them into non-overlapping locations, and whenever you want to use a different one re-POKE the appropriate locations.

To save a word or message, you must know how long it is in terms of bytes, as opposed to where in memory it ends. The length can be found with this formula:

L=(PEEK(252)-PEEK(7))*256

In this example, the length is 4096 and it starts at 24576 so we can type:

BSAVE MESSAGE #1,A
24576,L 4096

A typical program to use this is shown in Listing 3.

```
10 PRINT CHR$(4);"BLOAD VOICE"
15 PRINT CHR$(4);
   "BLOAD MESSAGE #1,A 24576"
20 POKE 6,0: POKE 7,96: POKE 251,1:
   POKE 252,112
25 CALL 874
30 END
```

When you load the data, as in line 15, it is a good idea to specify where in memory you expect it to go; that is done with the phrase 24576.

If the program in which you use voice also uses strings, it will be necessary to set HIMEM to avoid clobbering your data. □

An In-Depth Look At The Program

$0300 to $0319 START

Transfers the input data directly to the speaker and checks for a keypress

$031A to $0332 RECORD

Calls the INIT routine, then checks the cassette and puts the data on a stack, then INCREMENTS and does a DELAY.

$0333 to $0345 INIT

Sets all the pointers and scratch pad locations. Puts locations $06 into $FD and $07 into $FE

$0346 to $04B DELAY

Just a simple delay loop

$034C to $0369 INCREMENT

This is really the heart of the program. As well as incrementing the memory pointer, it sets the masks for the next bit position to be used. If the memory allotted has been exhausted, it pops the stack and ends the current routine.

$036A to $0383 PLAY

Starts by calling INIT and then gets a piece of data. If that piece is different from the last, it clicks the speaker. Afterward it does the DELAY and INCREMENT.

Special Locations	
$0006,7	Beginning of data pointer
$0008	Mask (one bit off)
$00FA	Mask (one bit on)
$00FB	Speed
$00FC	Length
$00FD,E	Memory pointer (from $06,7)
$00FF	Status of speaker

The data are stored and retrieved in a strange order. First, all the data are stored in bit 0 of each byte, then the program loops back and puts the data into bit 1. This continues until all bits are full; then the routine ends. Data are retrieved in the same order.

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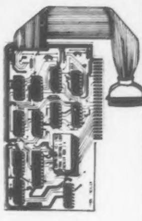

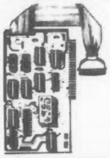

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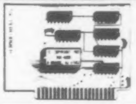

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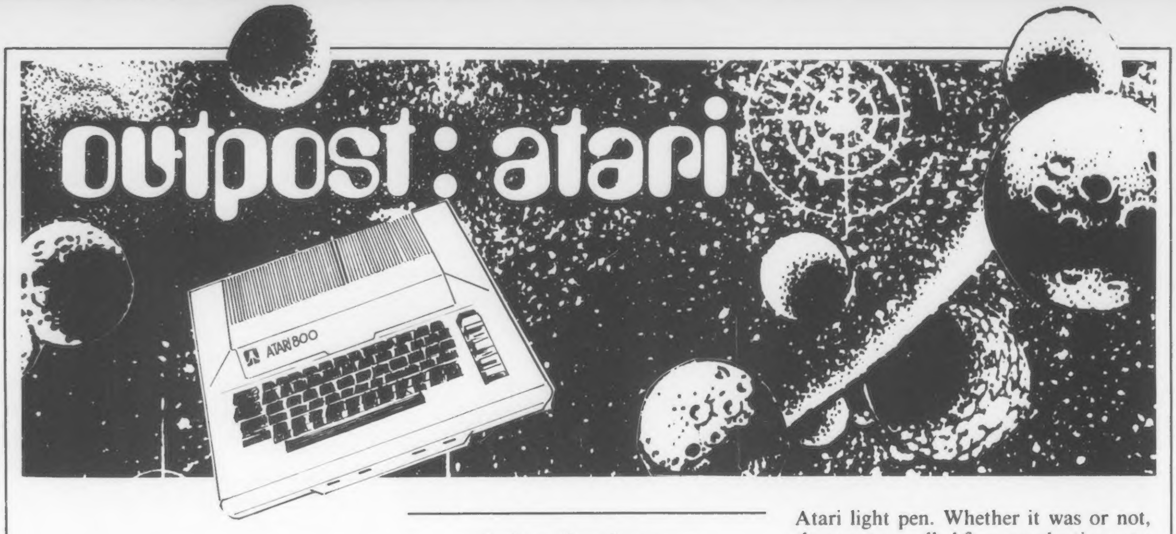


John Anderson

We will take a bit of a diversion in this edition of the Outpost, to take stock of a promising, yet somehow neglected input device for the Atari computer: the light pen. We will look at the capabilities of such a device, and review a pen available for the Atari as well as other machines. We shall go on to outline steps involved in the construction of an inexpensive but fully functional pen, using readily available parts.

If light pens don't sound to you like a topic that should necessarily elicit heated controversy or a complex and somewhat absurd tale, you are justified, but incorrect. Remember, you own an Atari, so anything is possible. Read on.

In the atmosphere of inspiration that couched the design of the Atari 400/800 computer, foresighted engineers built a great many capabilities directly into the hardware of the machine. Among these was the capability to support a light pen without the need for any additional controller boards. Even today, not too many other machines can make this claim. A light pen can be quite simply plugged into controller port 0, as if it were a paddle or joystick. It can be read straightforwardly with the statements PEEK(564) and PEEK(565). And that is all there is to it. That is, from an engineering point of view, you understand.

Those with machines of recent acquisition may not be aware that at one time Atari itself slated a light pen for production. It was to cost less than $100. In the second quarter of 1981, a products brochure that showed the device in use was released. It was a stubby, fat hunk of plastic with a tip switch on it. And what pretty multicolor pictures it supposedly drew.

Mail-order houses, as they are wont to do, accepted back orders on the Atari pen for some time. Though the decision to kill it was made over a year ago, the product was listed in a few retail rosters until only a few months ago.

At some point during its short development, a decision was made to pull the pen. The reasons for this remain somewhat vague. Some have suggested that the tip switch was flaky, making the device unreliable.

Another explanation I have heard from more than one reliable source goes like this: The Atari is designed as the machine for *everybody*, including novices and kids. Marketing was skitterish about the idea of a tiny kid fooling around a TV tube with a big pointy stick. One false move and gazonga: Mommy finds Billy on the living room floor, a victim of implosion! "Think of the lawsuits," said the legal department. "Pull the pen," said marketing.

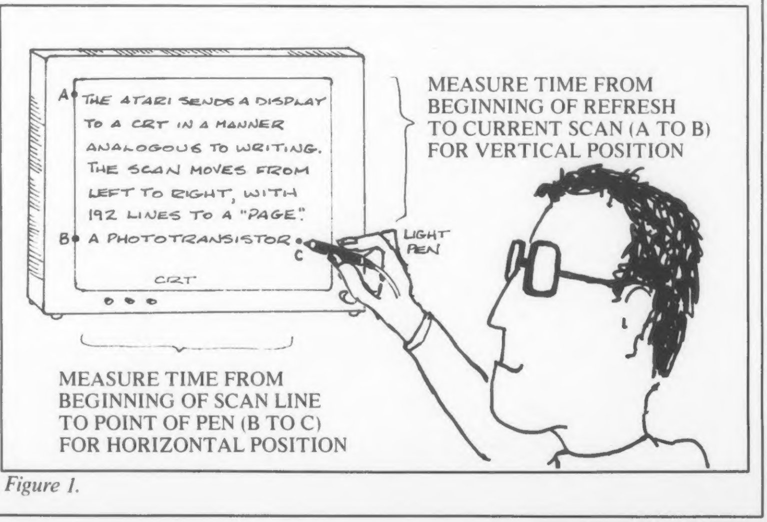
Stop laughing. This may or may not have been the last straw concerning the Atari light pen. Whether it was or not, the pen was pulled from production very swiftly, and it is unlikely the decision will ever be reversed. A few did manage to get off the assembly line, however, and the few people who own them quite properly regard them as collector's items.

Hobbyists like myself, who have read about the capabilities of light pens and know also of the built-in pen capabilities of Atari machines, awaited the appearance of Atari-compatible light pens from other sources. Surprisingly, at least to me, no cheap pen has become available in the ensuing time. It is too bad, really. The peripherals can do a lot to make a microcomputer friendlier.

Just how can they do this? Kind of you to ask. First, let's find out what they do.

Light On The Subject

A light pen, when touched to or aimed closely at a connected monitor or TV screen, will allow the computer to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THE SCAN MOVES FROM
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192 LINES TO A "PAGE."
B
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C
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Figure 1.

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determine where on that screen the pen is aimed. The driver program may subsequently take that information and do various things with it, but the job of the pen itself is quite simply to make a time measurement, which will be translated into x and y coordinates representative of a position on the CRT.

The capability may seem remarkable, and it is, though a simple explanation of how it works may dispel some of the awe. You may be aware that a TV or raster monitor typically *refreshes* at a rate of 60 frames per second. That is to say the electron gun or guns draw 60 pictures on the screen in one second. But it is impossible to draw an entire picture at once. Rather, the picture is drawn by the *scan line*, starting in the upper left-hand corner, moving to the right. When a line is completed, work begins on the next line. The Atari standard is 192 scan lines per frame. (An excellent explanation of this mechanism was provided by David Small in the June and July 1981 issues of *Creative*.)

Now let's imagine we have a special kind of transistor: one that is sensitive to light. We have hooked this transistor to our Atari, and aimed it at a point on the screen. By noting when a scan goes by and measuring the interval between scan lines or entire screen refreshes, we can get a good idea where the phototransistor is pointed on the video screen. The pen then allows us, through software, to generate x and y vectors corresponding to a point on the screen, which we may then use to draw pictures, make a choice from a menu of alternatives, or answer questions put to us by a program. Figure 1 is a simplified diagram of the process.

As opposed to input via the keyboard or even a paddle or joystick, a light pen can be a dramatically friendly peripheral. Imagine needing merely to point the device at your choice on the screen, in order to make that choice. Or to draw a picture on your CRT as straightforwardly as you might use a crayon on a piece of paper. These are the kinds of possibilities a light pen affords.

By the way, you would have to work extremely hard to push a light pen *through* a CRT. It just isn't something you could do without extreme effort, assuming you could do it at all.

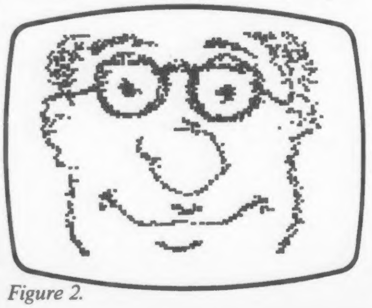


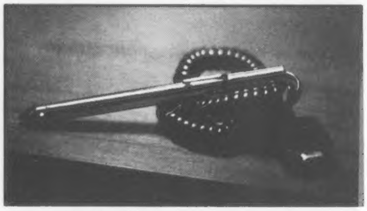
Figure 2.

Mightier Than The Sword

Soon after the Atari pen bit the dust, a third-party pen for the Atari appeared from Symtec Corporation. This pen is about the most professional you can find for any machine. It is, in fact, an adaptation of the same model used in professional mini and mainframe operations. Its barrel is of heavy, extruded aluminum, with a coiled telephone handset wire leading to an Amphenol connector. It includes a sensitivity trimmer adjustment. Everything about the Symtec pen is top of the line, including the $150 price tag.

Figure 2 provides an example of the drawing capabilities of the Symtec pen. The software driver I used to create the caricature (portrait) of our fearless leader, Mr. Ahl, appears as Figure 3. In ten lines, the code evidences how elementary a driver can be. This is an obvious benefit of the fact that so much of the work is already done in hardware.

If you wish to endow your Atari with professional light pen capability, the Symtec pen is literally without rival on the market. The pen is also available for the Apple, IBM PC, and VIC-20 machines. For more information, contact Symtec, 15933 West 8 Mile, Detroit, MI 48235. (313) 272-2952.



Syntec Light Pen.

Penlight Light Pen

Of course, many Atari hobbyists will be unable to budget that kind of money for a light pen purchase. I believe the market exists for an inexpensive pen, but no company has yet stepped forward with such a product. Other inexpensive pens, for machines such as the Apple and TRS-80, can be modified for use with the Atari. I reasoned, however, that it wouldn't entail very much more work to start from scratch. It would also be much cheaper.

```
 10 GRAPHICS 7+16
 20 SETCOLOR 4,0,14:COLOR 3
 30 X=PEEK(564)
 40 IF X<70 THEN X=X+230
 50 Y=PEEK(565)
 60 IF Y<17 OR Y>112 THEN 50
 70 X=X-75:Y=Y-14
 80 IF X<0 OR X>159 THEN 30
 90 TRAP 30:IF STICK(0)=15 THEN
    PLOT X,Y
100 GOTO 30
```

Figure 3.

The result: for a couple of hours work and about $10 worth of hardware, you can put a homemade Atari light pen to work with your system. While it will have neither the accuracy nor the feel of the Symtec pen, it will be perfectly serviceable for many applications, and loads of fun to play with. It is also easy to make. So let's make one!

Home Brew Light Pen.

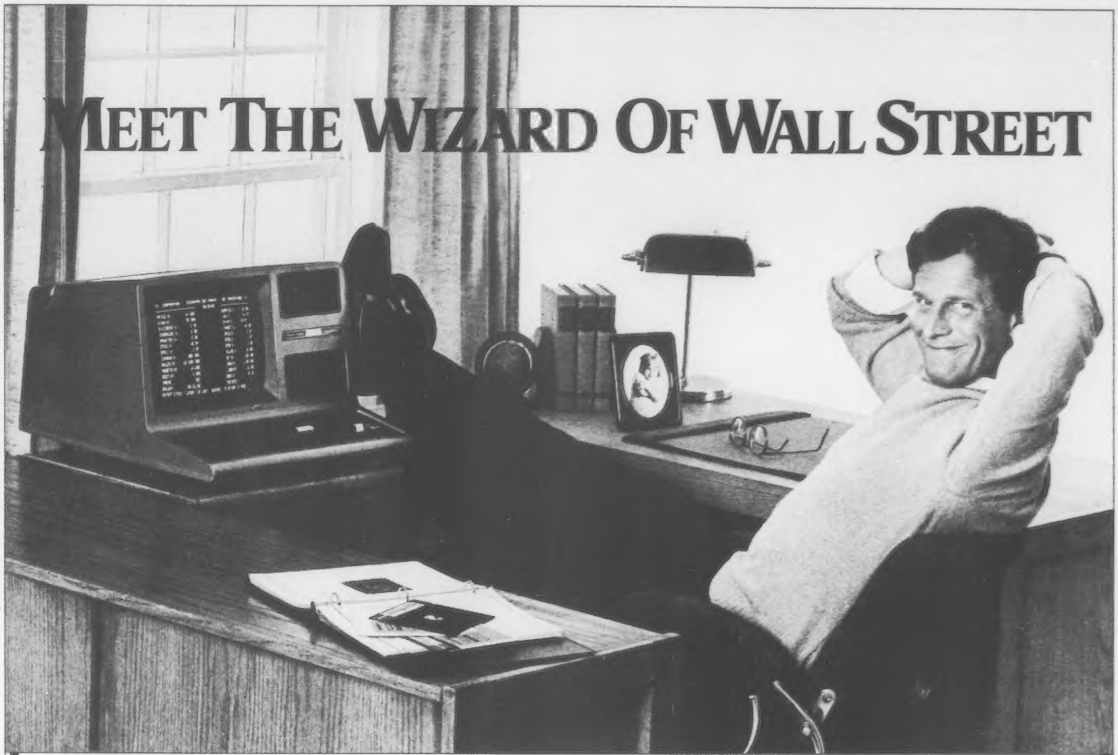
First, you've got to stock some parts. Get down to the nearest Radio Shack, and pick up the following: one phototransistor, model number 276-130, 89 cents: ½ watt 100K ohm resistor, model number 271-045, 19 cents for two: penlight, model number 61-2626, $1.99.

You will also need a few other pieces of paraphernalia. These include: DE-9 connector plug for the controller port on the Atari, and five-conductor shielded cable (you cannot use an existing Atari joystick, as it lacks necessary pin-outs); a couple of feet of insulated bell or stranded wire; and the plastic top to a Bic pen. You may also want a grommet or strain relief for the pen top.

For tools, you'll need this array: low wattage soldering iron and solder; wire cutters (needlenose pliers are handy too); X-acto or razor knife; scissors or reamer; small flat blade and Philips screwdrivers; long stick pin or safety pin; and insulating electrical tape.

Got these things together? Let's get going. First, unscrew the cap on the penlight, and disassemble the light bulb and bayonet assembly from the white plastic pen tip. Next, gently press the switch assembly down through the barrel of the pen with the Philips screwdriver. We don't want a penlight anymore, and we need all the real estate inside it in order to convert.

The cable we connect will feed through the hole where the on/off switch used to reside. You will pop the switch out through the open side of the barrel, along with two springs and a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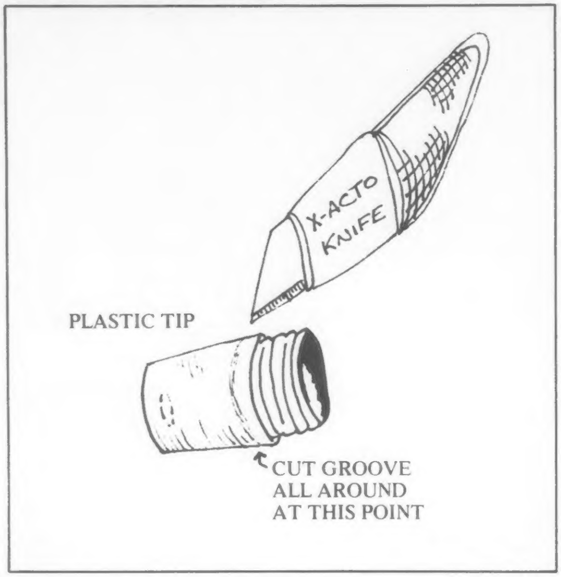

X-ACTO KNIFE
PLASTIC TIP
CUT GROOVE ALL AROUND AT THIS POINT

Figure 5.

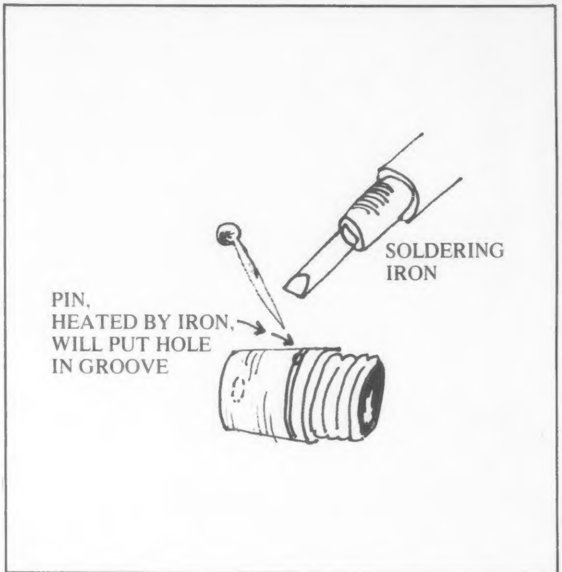

SOLDERING IRON
PIN, HEATED BY IRON, WILL PUT HOLE IN GROOVE

Figure 6.

black plastic retaining collar. When these things have been pushed out, the barrel will be empty, and that's the way we want it.

Using a closed pair of scissors or a reamer, enlarge the switch hole on the metal barrel top until it accommodates the wire, grommet, or strain relief on the connector wire you have chosen. When this is accomplished, push the pen barrel onto the wire (it would be embarrassing to construct the entire pen, then discover you left the barrel aside, and have to disassemble all your work to fit it on).

Take the phototransistor, and hold it so that the bottom is facing you. Turn it until it is oriented along the lines of the diagram presented as Figure 4. This will indicate the positions of collector, base, and emitter leads of the component. You can clip the base lead short, as we will not be making use of it.

Solder directly to the collector lead one 100K resistor, along with a plain lead about four or five inches long, as indicated in Figure 4. Solder another lead of about the same length to the emitter lead, also as indicated. Don't use a high wattage iron or apply heat for too long, as you run the risk of blowing the transistor.

Using the X-acto knife, cut all the way around the plastic tip of the pen light, at a distance of about $\frac{1}{8}$ of an inch up from the threaded side, as indicated in Figure 5. Run the blade around the plastic tip repeatedly, until a rudimentary trench begins to appear. Once it does, use the flat blade screwdriver to widen and deepen the groove. This groove will hold the touch ring, which we shall use as the switch on our pen, in place.

Next, using the stick pin or an open safety pin, you will put a hole in the groove. Place the end of the pin in the groove, then put the tip of the soldering iron on the pin. Grasp the pin with the pliers or far enough back to avoid burning yourself. The plastic will melt only around the pin, and you'll have a clean hole through the pen cap. Work the hole out to about the diameter of a pencil lead. The touch ring wire will have to fit out and back into the pen through this hole. Figure 6 will help you gain a clear idea of what you're trying to do.

Figure 7 indicates the manner of

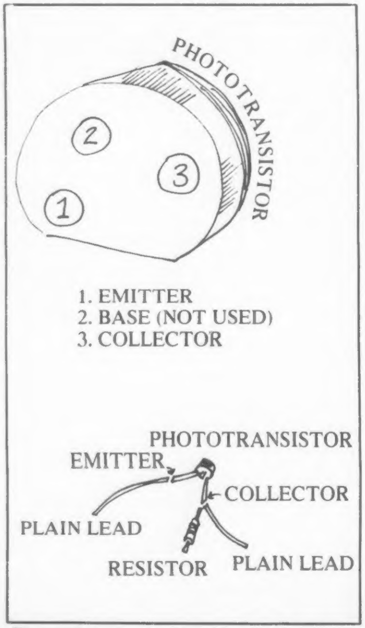

PHOTOTRANSISTOR
2
3
1
1. EMITTER
2. BASE (NOT USED)
3. COLLECTOR
PHOTOTRANSISTOR
EMITTER
COLLECTOR
PLAIN LEAD
RESISTOR
PLAIN LEAD

Figure 4.

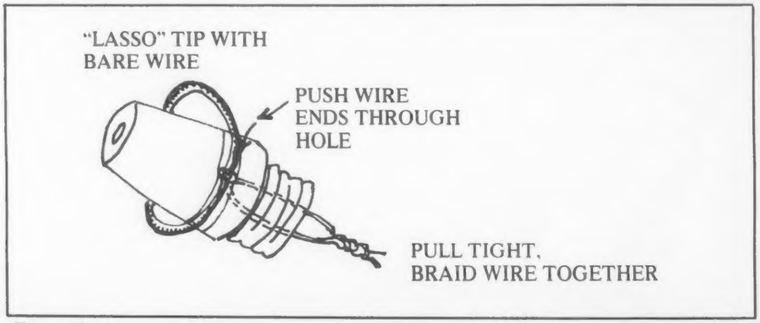
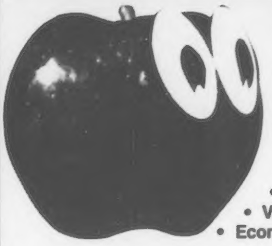

"LASSO" TIP WITH BARE WIRE
PUSH WIRE ENDS THROUGH HOLE
PULL TIGHT, BRAID WIRE TOGETHER

Figure 7.



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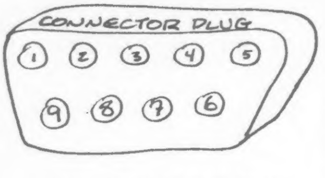
construction of the touch ring. Strip a five inch or so length of wire entirely. If it is stranded as opposed to solid wire, make sure that you have twisted it together thoroughly, or it will unravel while you are threading it into the pen tip. The wire will loop all the way around the pen tip, into the groove hole, and should be tightly twisted to itself on the inside.



NOTE: THIS IS THE *PLUG*
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MIRROR IMAGE.

6-(PENHOT)-DIRECTLY TO COLLECTOR
7-(+5v)-TO RESISTOR
8-(GROUND)-TO EMITTER + PEN BARREL
9-(PADDLE 0 HOT)-TO TOUCH RING

Figure 8.

We are now ready to wire up the pen. Figure 8 provides a wiring diagram for connection to controller port 0. We shall be using the analog reading of Paddle (0) to tell us whether the touch ring is open or closed. The ground, pin 8, and the Paddle (0) hot lead, pin 9, form the touch ring circuit. As it turns out, this is an extremely convenient manner in which to activate and deactivate the pen. The resistor is connected between the collector and +5 volts, which is pin 7. The collector is also connected directly to pin 6, which is the hot pen lead. The emitter attaches to ground, which as stated, is pin 8 on the controller plug.

After the connectors have been soldered together with their respective leads, a test of the pen is in order, to make sure everything will be working when it is assembled. Plug the pen in, boot Atari Basic, and type the following:

```
10 SETCOLOR 2,0,14:SETCOLOR
1,0,0:?
PEEK(564),PEEK(565),
PADDLE(0):GOTO 10
```

Upon running the program, hold the phototransistor up to different points on the screen, and ascertain that you are getting different readings for each position. Don't worry yet whether the readings are perfectly reasonable. Just make sure they change when the pen position changes. If they don't, you probably made a wiring mistake somewhere.

When you touch the leads coming from pins 8 and 9 together, the last value printed in the program loop should move well down from its default, 228. If you are getting different PEEK values and paddle values, all is well, and you are in the home stretch.

Using the insulating tape, wrap up the pen wiring assembly so that nothing will short out when it is squeezed into the pen barrel. There is plenty of room in the pen for the assembly, so you shouldn't have to force anything.

Next solder two four- or five-inch insulated leads to connectors 8 and 9, which will detect our touch ring. One of these leads will connect directly to the tail of the touch ring, and the other will ground to the exterior barrel of the pen. This is easily effected by wrapping a generous length of stripped lead through the square hole in the plastic tip, as indicated in Figure 9. Then, when the plastic tip is screwed on, a good ground connection will be made via friction fit.

It is imperative that the connection to the touch ring itself be well insulated—your electrical tape will come in handy again here. Make sure no bare wire is left to accidentally short the switch. That way it will only close when your finger shorts it.

We're almost done. Bet you have been wondering what our Bic pen top is for. Well, now we need it. Cut off the tip and the bottom with the X-acto knife, as shown in Figure 10, so just about a half inch from near the top is left. This remaining collar will act as a guide for the phototransistor in the pen tip. Press it into the plastic tip, tapered side first, as shown.

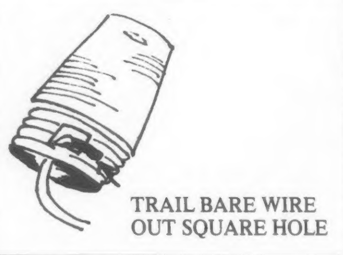

Figure 9.

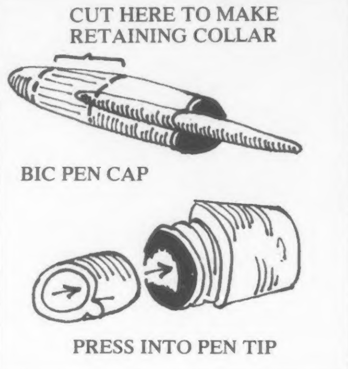

Figure 10.

After making a final inspection to ensure all bare wire has been insulated, push the wiring assembly into the barrel of the pen, leaving just the phototransistor peeking out about a half inch, and of course the switch leads and tip. Carefully screw on the tip, making sure that the phototransistor is seated well in the pen collar, and that a satisfactory ground connection is being made between the lead looped outside the plastic cap and the barrel of the pen. And that's it.

Conduct another test, identical to the earlier one. If results are unsatisfactory, you'll have to undo things and find out where you went wrong. If you are having trouble activating the touch ring, try

```
10 GRAPHICS 7:SETCOLOR 1,0,0:SETCOLOR 2,12,14:SETCOLOR 4,0,14:COLOR 1
20 POKE 752,1:? "TO DRAW, TOUCH THE PEN TO THE SCREEN,"
30 ? "THEN TOUCH AND RELEASE THE RING."
40 IF PADDLE(0)=228 THEN 40
50 X=PEEK(564):IF X<50 THEN X=X+230
60 Y=PEEK(565)
70 X=(X-95):Y=(Y-14)
80 TRAP 50:IF PADDLE(0)<228 THEN PLOT X,Y
90 IF PADDLE(0)<228 THEN 90
100 ? :? :? "TOUCH THIS BAR TO REVERSE COLOR, AND"
110 ? "BELOW THIS BAR TO ERASE."
120 X=PEEK(564):IF X<50 THEN X=X+230
130 Y=PEEK(565)
140 X=(X-95):Y=(Y-14)
141 IF Y>96 THEN 10
142 IF Y>83 AND Y<96 THEN 300
150 TRAP 120:IF PADDLE(0)<228 THEN DRAWTO X,Y
160 IF PADDLE(0)<228 THEN 160
170 GOTO 120
300 Y=0:SETCOLOR 4,0,0:? :? :? "TOUCH THE RING TO CONTINUE..."
310 IF PADDLE(0)=228 THEN 310
320 X=51:Y=0:SETCOLOR 4,0,15:GOTO 20
```

Figure 11.

wetting your finger before you dismantle anything. Because we are reading the resistance between the ring and the barrel of the pen, a dry finger can sometimes be the culprit.

You should now have a relatively neat looking as well as functional light pen, that passes the one-line software test with flying colors. The time has come to begin refining that software dramatically.

I will provide two starting points. Figure 11 is a drawing program, which will give you an idea of how good (or bad) the pen is at locating itself. I built three pens, and the calibration seemed pretty consistent among them. Of course your monitor will have much to do with pen calibration.

The first place to look is line 70. Values in this line should be altered until the plot occurs right underneath the pen tip. If the left side of the screen reads okay but the right half is out, you may have to fiddle with the value in line 50. Don't get nervous. For most folks, the values shown in the program will be pretty close to perfect.

You will quickly see that the pen is much more accurate at vertical measurement than at horizontal. This is probably its biggest shortcoming, though it has others. For one, the screen must be extremely bright to get a good reading. For this reason I have included an option to reverse color, which is chosen by pointing the pen to the text window and touching the ring. To erase, move the pen below the bottom edge of the text window.

```
10 GRAPHICS 0:SETCOLOR 2,0,0:SETCOLOR 4,0,0
20 ? :? :? :? :? "Question 1."
30 ? :? "How many zweckas does it take to fill"
40 ? "a quackenbush?"
50 ? :? :?
60 ? "□ONE"
70 ?
80 ? "□TWELVE"
90 ?
100 ? "□HUNDREDS AND HUNDREDS"
110 ?
120 ? "□WHO CARES ABOUT QUACKENBUSHES?"
140 POSITION 2,22:IF Y>60 AND Y<64 AND PADDLE(0)<228 THEN ? "You must
    have a tiny quackenbush! "
150 POSITION 2,22:IF Y>66 AND Y<70 AND PADDLE(0)<228 THEN ? "No, but
    there are in a dozen.      "
160 POSITION 2,22:IF Y>76 AND Y<80 AND PADDLE(0)<228 THEN ? "You bet
    it does, buddy.            "
170 POSITION 2,22:IF Y>82 AND Y<86 AND PADDLE(0)<228 THEN ? "That's
    the wrong attitude to have."
180 GOTO 130
```

Figure 12.

Figure 12 is a simple menu selection program to give you an idea of the convenience of a light pen for varied information input. The pen you have built is more than accurate enough to support a function such as this. The squares in the listing are obtained by pressing the Atari key, followed by a space.

Needless to say, these examples are presented just to get you started. Your imagination can take it from here. So there you have it. You need never be stymied again when people ask you about the light pen capabilities of the Atari machine. In fact, they may be sorry they asked! □

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Will Fastie

A year's worth of columns has generated a steady flow of mail much, I think, to the postmans's chagrin. The letters vary, of course. About half are just chit chat, or a listing of a favorite program, or a clever(?) one-liner. The rest are questions, most of which do come with a return envelope. I have received letters from all of the countries in Western Europe and Great Britain; from Egypt, Israel, and Saudi Arabia; from South Africa; from Canada; and from Chile, Venezuela, Argentina, and Brazil. The international respondents are usually apologetic about not sending a stamp, but they send coin quite often. Josh's collection, begun modestly as a result of my own infrequent travels, is growing.

Two questions are asked frequently. This column is about those two questions. One I can dispose of quickly, but the other consumes the bulk of this column and, depending on my mood during the holidays, may chew up some of next month's as well. First, the easy one.

The CompuCable Friction Feed Kit

Of all the products I have mentioned, none has aroused more interest than this one. It is a kit of parts that converts an Epson MX-80 printer (or IBM 80 CPS printer) from a tractor-driven, continuous-forms printer to one that can take cut sheets.

The first half of the question is "Who is the manufacturer and where are they?" Answer: They are CompuCable Corporation, and they are located at 1440 South State College Blvd., Suite 6-J, Anaheim, CA 92806. The phone number is (714) 635-7330.

The other half of the question is "How are you doing with yours, and do you still like it?" Answer: Just fine, thanks, and I do still like it. For a variety of reasons, I would prefer an Epson MX-80 F/T instead, but I think the CompuCable kit is a reasonable alternative for those of us who bought either the IBM or a pre-F/T Epson. I would like to be able to adjust the tractors for other paper widths, but I haven't really had the need.

I find single sheets a little difficult to feed. Practice is required until you get the hang of it. Envelopes do not exactly fit, since they are wider than the platen and thus overlap the pinwheels. To do envelopes, I have a special addressing program (see Listing 1). I insert the envelope, type in all the lines of the address, correct them if necessary, and initiate the print. The program then delays for several seconds so I can put extra pressure on the rollers. It is awkward, but again, infrequent.

The only problem I will report has nothing to do with cut sheets. The modified printer has a slight tendency to wrap continuous paper around the platen. This contingency is provided for in the design of the kit, but it happens once every hundred pages anyway. The problem appears to be that the kit is less effective at lifting the sprocket holes off the tractor pins than the original Epson equipment.

I still do recommend this product. It certainly has been worth having, and the minor inconveniences are far outweighed by the function for which it was intended.

Getting At BIOS, et. al.

The hard question I am regularly asked is how system functions can be accessed from the higher level languages. The majority of writers ask about IBM Pascal, which unfortunately does not provide access to many of the functions that even Basic supports well. For example, there is no Pascal analog for the Basic statement CLS, which clears the screen. There is no way to make specific IBM DOS calls, or to gain access to the ROM BIOS.

Even with Basic, there are still features that cannot be had, and I have been asked about interfacing both Basic and Compiled Basic to the system. This month I will show you how to do it with Pascal, and at some later time we will take up Basic.

How The System Works

To understand the programs I am presenting this month, you must understand something about the way the PC works. Here is a nutshell explanation.

W. H. Fastie, 7110 Sheffield Road, Baltimore, MD 21212.

Listing 1.

ADDRESS.BAS

```
10 ' Program to address envelopes
20 ' WHF - 16 Feb 82 (revised 21 Mar 82)
30 DIM LINES$(10)
40 ENTERING=1: EDITING=ENTERING+1
50 LPMODE$= CHR$(27)+"E"
60 PROG$="ADDRESS v1.00 21-Mar-82"
70 CLS: KEY OFF
80 PRINT PROG$: PRINT
90 MODE=ENTERING
100 NLINES=0
110 CURRLINE=1
120 GOSUB 390
130 IF LEN(LINES$(CURRLINE))=0 THEN IF NLINES=0 THEN END ELSE 170
140 NLINES=NLINES+1
150 CURRLINE=CURRLINE+1
160 GOTO 120
170 ' edit routine
180 MODE=EDITING
190 LOCATE 4+NLINES+2,20: INPUT "Any changes?  (Y or [N])  ",X$
200 LOCATE 4+NLINES+2,20: PRINT STRING$(30," ");
210 IF LEN(X$)=0 THEN 280
220 X$=LEFT$(X$,1)
230 IF X$<>"Y" AND X$<>"y" THEN 280
240 LOCATE 4+NLINES+2,20: INPUT "Which line?  ",CURRLINE
250 LOCATE 4+NLINES+2,20: PRINT STRING$(30," ");
260 GOSUB 390
270 GOTO 170
280 ' print envelope
290 INDENT=45
300 LOCATE 4+NLINES+2,1
310 PRINT "Put the envelope in the printer."
320 PRINT "There will be a 4 second delay -- HOLD THE ROLLERS!"
330 FOR I = 1 TO 4*(1000): NEXT
340 FOR I=1 TO NLINES
350   LPRINT TAB(INDENT);LPMODE$;LINES$(I)
360 NEXT I
370 FOR I = 1 TO 10: LPRINT: NEXT I
380 GOTO 70
390 ' get one line into data array
400 LOCATE 4+CURRLINE,20
410 PRINT USING "Line #:  ";CURRLINE;
420 IF MODE=ENTERING THEN PRINT STRING$(45," ");
430 IF MODE=EDITING THEN PRINT LINES$(CURRLINE);
440 LOCATE 4+CURRLINE,29
450 LINE INPUT "",LINES$(CURRLINE)
460 IF MODE=ENTERING AND LEN(LINES$(CURRLINE))=0
      THEN LOCATE 4+CURRLINE,20: PRINT STRING$(10,32)
465 IF MODE=EDITING THEN LOCATE 4+CURRLINE,29: PRINT STRING$(45,32):
      LOCATE 4+CURRLINE,29: PRINT LINES$(CURRLINE);
470 RETURN
```

The PC is delivered with some programs in permanent memory, usually referred to as "read-only memory" or ROM. The ROM contains three sections of code: Cassette Basic, diagnostics, and the "basic input/output system" or BIOS. The BIOS is very important, because it provides the basic services that make the PC run. For example, it contains the program that decodes the keyboard and translates keyboardspeak into ASCII characters. More to the point for my readers, it contains a large chunk of code to manage the video displays, both monochrome and graphic. Access to these routines is achieved through the use of interrupts.

Usually we think of an interrupt as something caused by an external event—for example, the depression of a key on the keyboard. The IBM PC (using Intel parts) allows the processor to ignore quiescent devices most of the time, attending to them only when they raise their hands and yell for help. The yell is the interrupt, which causes the CPU to stop what it was doing and transfer control to a program that knows what to do with that particular kind of interrupt. When that program is done, the processing of the original program can resume.

The 8088 includes an interrupt instruction (INT) which has precisely the same effect. In fact, the instruction can be used to simulate the behavior of a device even if the device is not present in the system. When used in a program, the instruction is similar in behavior to the more familiar subroutine call. Except for one thing.

The INT instruction requires that a single specific location in memory contain the address of the routine to which control is to be transferred. A table of addresses, one for each of the 256 interrupts supported by the processor, is maintained in RAM memory at absolute locations 00000H to 003FFH. The CALL instruction, in contrast, allows its address to be virtually anywhere, imposing no restrictions.

But so what? Why does this facility bring so much power to a program? In general, it does not. However, it is especially useful for operating systems and is extremely valuable when some of the programs to be called reside in ROM.

Consider this. Suppose IBM found a critical bug in the video driver code in the ROM BIOS. Straight away they fix it and start delivering machines with new versions of the ROM. But what about you and me? Because the video code is accessed through an interrupt, IBM could supply a program that would modify the contents of the position of that interrupt in the table to point instead to the fixed version in normal (RAM) memory. In fact, that is exactly what happened with the Basic bug. Cassette Basic also had the bug, which meant the bad code was in ROM. IBM distributed a new disk version of Basic which did not have the bug. How? By plunking a repaired version of the code in main memory and adjusting the interrupt table to point to it.

As it happens, all the fundamental capabilities of the PC are accessed through the interrupt system, including calls to IBM DOS and execution of Basic statements. So if you are trying to do something outside the scope of the programming language with which you are working, you need to be able to issue an interrupt, something that is not quite as simple as it sounds unless your language is assembly.

PSYSINT Is Born

What we need is a routine that can be called from Pascal to invoke an interrupt service routine. Pascal must provide the information which normally is placed in the CPU registers, and the routine must get that information into the proper registers. Since some interrupts will return information, the routine must provide a mechanism to pass data back to the caller.

Rather than write such a routine from scratch, I decided to adapt (with permission) the routine SYSINT from George Eberhardt's C86 Compiler for the PC. I have modified it primarily for clarity, although I have made it slightly less functional as well. The Pascal version of

IBM Images, continued...

SYSINT, or PSYSINT, is shown in Listing 2.

Listing 2.

```
The IBM Personal Computer MACRO Assembler


 1                            page 54,130
 2                            ; PSYSINT - IBM Pascal interface to the world
 3                            ;
 4                            ; Author:   Will Fastie
 5                            ; Source:   PSYSINT.ASM
 6                            ; Created:  23 Nov 82
 7                            ; Edited:   26 Nov 82  2145
 8                            ;
 9                            ; Adapted from George Eberhardt's version for the Computer Innovations
10                            ; C86 Compiler, with permission.
11                            ;
12                            ; Pascal calling sequence:
13                            ;
14                            ;       PSYSINT(INT: WORD; VAR SREG, RREG: REGSET): WORD;
15                            ;
16                            ; SREG and RREG are two records of four words each representing the 8088
17                            ; registers AX, BX, CX, and DX.  REGSET is an IBM Pascal type
18                            ; defining these as well as all the half-register names (e.g., AL, AH).
19                            ;
20                            ; INT is the number of the system interrupt desired.
21                            ;
22                            ; The return value is a 16-bit datum of IBM Pascal type WORD.  It contains
23                            ; the machine status register.
24                            ;
25                            ; This IBM Pascal calling sequence passes the INT as a value and the two
26                            ; register sets as pointers to their respective structures.
27                            ;
28                            ; The incoming stack looks like this in memory locations "mem".  Note
29                            ; that the call is a FAR call (page 10-16 of the IBM manual), so both
30                            ; the return address and the segment address are pushed.
31                            ;
32                            ;               mem + 00:     return address          <-- SP
33                            ;               mem + 02:     return segment
34                            ;               mem + 04:     RREG address
35                            ;               mem + 06:     SREG address
36                            ;               mem + 08:     INT  value
37                            ;               mem + 0A:     upper frame pointer     <-- BP
38                            ;
39     0000                   example segment byte public
40                                    assume cs:example
41                                    public psysint
42                            ;
43     0000                   psysint proc    far
44     0000  55                       push    bp              ; save caller's frame pointer
45     0001  8B EC                    mov     bp,sp           ; set up our frame pointer...
46     0003  83 C5 02                 add     bp,02H          ; ...avoid the BP pushed above
47                            ;
48     0006  E8 0009 R                call    dummy           ; trick - push the IP
49     0009                   dummy:
50     0009  58                       pop     ax              ; get it
51     000A  2D 0009 R                sub     ax,offset dummy ; calculate the location of the INT
52     000D  05 001D R                add     ax,offset pint
53     0010  8B F8                    mov     di,ax           ; move it to the index register
```

Let's take a look at this and see just what it does. The first three instructions (lines 44 to 46) are required for the Pascal environment, and make some adjustments to the stack and frame pointers. The program then uses a "trick" to get the current instruction pointer location by calling a subroutine at the next location. This transfers control to the next location after pushing a return address (DUMMY) onto the stack. This address is immediately used to calculate the location of the INT instruction on line 58. The desired interrupt number is retrieved from the parameter list of the subroutine and inserted in the instruction.

I apologize for this technique. I should not write code like this, but it is considerably more obvious than George's perfect simulation of the INT instruction (see box). In general, self-modifying code is something to be avoided.

Once the INT is set, the register values must be inserted into their proper registers. This is accomplished by the REGSIN routine, which PUSHes all the passed values onto the stack and then POPs them into their proper registers. Then the interrupt instruction is executed, and the requested service is obtained.

When the service routine is done, control is transferred back to the location following the INT instruction, at which point the process described above is reversed. The routine REGSOUT gets the values in each register and puts them in the record passed as an argument to PSYSINT.

Using PSYSINT

Great. Now we have this nifty routine, but how do we get at it from Pascal? That's what Listing 3 is all about. It contains three interface routines (CLS, LOCATE, and CHROUT) which demonstrate how to write Pascal for PSYSINT. There is also a short main program which tries the new features.

The first thing we must do is define a new record type for the registers. This version of PSYSINT supports only the four general purpose registers AX, BX, CX, and DX, but the type REGSET (for register set) also includes the low and high portions of each since many BIOS routines expect values in a half-register. You should notice a peculiar feature about this record: the low half of the register is declared before the high half. This is because the record must exactly match the memory configuration of the register set: the 8088 stores 16-bit values with their two 8-bit halves switched.

EXAMPLE then declares two register sets, SREG and RREG. We will use SREG to hold the register values needed to invoke a function, while RREG will hold any information returned from the routine. (A single register set would also serve if the original values were not needed after the call.) I also have described another WORD, called FLAGS. PSYSINT returns as its value all the processor flags, and we need a place to put them. Finally, PSYSINT is declared to the compiler, showing its three parameters and their types (again mentioning REGSET), the type of the return value, and the fact that the routine is external to this program, that is, not defined within this source file.

The three routines are self-explanatory if you have the IBM Technical Reference manual. All the calling sequences are documented in the ROM BIOS listing at the end of the book. A few comments are in order, however. First, CLS always assumes that the monochrome display in

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80 x 25 mode is the display mode, and therefore the value 2 goes in AL. The right way to do this is to find out what mode is currently active and pass that value. The procedure would then be completely general. The mode is stored in absolute location 00449H (or segment 40H, offset 49H, if you prefer) so it can be obtained by CLS if desired. In Pascal the ADR OF, ADS OF, and pointer constructs can be used to accomplish this, avoiding further assembly language.

Second, the routine CHROUT always writes the character to the video display with the white-on-black attribute. There is a call to the BIOS to write the character without changing the existing attribute, but I have been having some trouble with that one, and I didn't have the time this month to deal with it. CHROUT could be modified to include a parameter for the attribute character.

Finally, I have been cavalier in my use of "magic numbers." We refer to constants like 200, 210, and 20 as magic numbers because there is nothing in the program to indicate what their values mean. In this case, the range 200 to 210 represents 11 graphics characters, chosen to show the purpose for CHROUT.

These examples should serve to demonstrate how PSYSINT can be used to build a library of system interface routines to meet almost any need. PSYSINT should serve you well, provided ultimate speed is not a requirement, as the routine does impose a small additional overhead upon BIOS, already burdened with considerable overhead itself. And one final note: PSYSINT is not suitable for multitask or -program environments, because it is self-modifying and because it does not preserve the entire set of registers across the interrupt call. It must be modified to perform a complete simulation of the interrupt and to protect itself from reentrancy problems.

The Development Process

This is not the first time I have used the tools needed to build these programs. However, I got lost briefly in the development process (I didn't order the half-register pairs in the REGSET type properly at first) and I therefore spent considerably more time with the tools than I cared to. Here is a brief report.

I should first compliment IBM and Microsoft on the consistency of operation of all the language compilers, as well as the linker. These programs all behave in the same way, making it relatively easy to move back and forth between Pascal and the Macro Assembler, for instance. Once you have used one, you have used them all. The only difference is the various options which are specific to each language.

Listing 2, continued...

```
0012  8B 46 08                  mov     ax,[bp+8]       ; get the desired interrupt number
0015  2E: 88 45 01              mov     cs:[di+1],al    ; put it in the INT instruction
0019  E8 0029 R                 call    regsin          ; get the registers from SREG
001C  55                        push    bp              ; we'll need our own BP later
001D  CD 00             pint:   int     00h             ; perform the requested interupt
001F  5D                        pop     bp              ; get our BP back
0020  9C                        pushf                   ; hang onto the flags for the return
0021  E8 003A R                 call    regsout         ; put the registers into RREG
0024  58                        pop     ax              ; flags are the return value
0025  5D                        pop     bp              ; restore the caller's frame pointer
0026  CA 0006                   ret     6               ; get rid of the arguments and return
0029                    psysint endp
                        ;
                        ; -------------------------------
                        ; Subroutines to move the registers in and out
                        ;
 = 0004                 nrregs  equ     4               ; this version supports only four registers
                        ;
0029                    regsin  proc    near            ; -- Move Registers In
0029  8B 5E 06                  mov     bx,[bp+6]       ; get address of register set SREG
002C  B9 0004                   mov     cx,nrregs       ; ...and how many registers to move
002F                    inloop:
002F  FF 37                     push    word ptr [bx]   ; push one
0031  43                        inc     bx              ; point to the next one...
0032  43                        inc     bx
0033  E2 FA                     loop    inloop          ; ...do it some more
0035  5A                        pop     dx              ; now pop them into their proper places
0036  59                        pop     cx
0037  5B                        pop     bx
0038  58                        pop     ax
0039  C3                        ret                     ; all done
003A                    regsin  endp
                        ;
003A                    regsout proc    near            ; -- Move Registers Out
003A  52                        push    dx              ; push all the registers in reverse order
003B  51                        push    cx
003C  53                        push    bx
003D  50                        push    ax
003E  8B 5E 04                  mov     bx,[bp+4]       ; get the address of RREG
0041  B9 0004                   mov     cx,nrregs       ; ...and how many registers to move
0044                    loopout:
0044  8F 07                     pop     word ptr [bx]   ; recover the register
0046  43                        inc     bx              ; point to the next
0047  43                        inc     bx
0048  E2 FA                     loop    loopout         ; do it again
004A  C3                        ret
004B                    regsout endp

004B                    example ends
                                end
```

```
Segments and groups:

                N a m e                 Size    align   combine class

EXAMPLE. . . . . . . . . . . . .        004B    BYTE    PUBLIC

Symbols:

                N a m e                 Type    Value   Attr

DUMMY. . . . . . . . . . . . . .        L NEAR  0009    EXAMPLE
INLOOP . . . . . . . . . . . . .        L NEAR  002F    EXAMPLE
LOOPOUT. . . . . . . . . . . . .        L NEAR  0044    EXAMPLE
NRREGS . . . . . . . . . . . . .        Number  0004
PINT . . . . . . . . . . . . . .        L NEAR  001D    EXAMPLE
PSYSINT. . . . . . . . . . . . .        F PROC  0000    EXAMPLE Global  Length =0029
REGSIN . . . . . . . . . . . . .        N PROC  0029    EXAMPLE Length =0011
REGSOUT. . . . . . . . . . . . .        N PROC  003A    EXAMPLE Length =0011

Warning Severe
Errors  Errors
0       0
```

Pascal runs pretty well. Its problem is its size, which makes it necessary to switch disks to get at various pieces of the compiler. This gets old fast. I'll get some relief next week when my 320K disk drives arrive, because I'll be able to combine the two passes of the compiler on a single disk. That will simplify things considerably.

The Pascal manual is generally complete. The description of the procedure and function calling convention, the very thing I needed to understand to write PSYSINT, is terrible. There are a few paragraphs giving some information, and then there is a poorly contrived example.

Listing 3.

```
EXAMPLE OF PSYSINT USE


 JG IC  Line#   Source Line       IBM Personal Computer Pascal Compiler V1.00
   00      1    {$title:'EXAMPLE OF PSYSINT USE'}
           2    {$linesize:132}
           3    {$debug-}
           4
           5    { Source:  EXAMPLE.PAS
           6      Author:  Will Fastie
           7      Edited:  27 Nov 82  0025 }
           8
   20      9    Program Example (input, output);
          10
          11    {Here are a few BIOS codes we need for these routines}
          12
   10     13    const
   10     14            videoio = 16#10;
   10     15              setmode = 16#00;
   10     16              writecursor = 16#02;
   10     17              writechara = 16#09;
          18
          19    {Define the structure to be used to pass values to PSYSINT}
          20    {Note that the 8088 stores 16 bit quantities low byte first, then
          21     high byte, thus the record below appears to be ordered backwards.}
          22
   10     23    type regset = record
   20     24            ax [00]: word;
   20     25                al [00]: byte;
   20     26                ah [01]: byte;
   20     27            bx [02]: word;
   20     28                bl [02]: byte;
   20     29                bh [03]: byte;
   20     30            cx [04]: word;
   20     31                cl [04]: byte;
   20     32                ch [05]: byte;
   20     33            dx [06]: word;
   20     34                dl [06]: byte;
   20     35                dh [07]: byte;
   10     36        end;
          37
   10     38    var
   10     39            sreg [public], rreg [public]: regset;
   10     40            flags: word;
   10     41            i: word;
          42
          43    {This declaration defines the external routine}
          44
   10     45    function psysint(int: word; var sreg, rreg: regset): word; extern;
          46

PSYSINT
```

How To Simulate An INT Instruction

If you are going to simulate it, first you must know how it works.

The following things happen (in the hardware) when the INT instruction is executed.

1. The CPU flags are pushed onto the stack.
2. The IF and TF flags are cleared (set to zero).
3. The CS (code segment) register is pushed onto the stack.
4. The memory location associated with the interrupt number in the instruction is computed. It contains the segment address and the segment offset of the interrupt routine.
5. The segment address is loaded into the CS register.
6. The PC is pushed onto the stack.
7. The segment offset is loaded into the PC register, which effects the transfer of control to the interrupt routine.

```
        pushf                       ;get the flags
        pop     dx                  ;save them for later
        push    dx                  ;(1) but keep a copy stacked
        push    cs                  ;(3) save the code segment
        call    dummy               ;push IP to find out where
                                    ;we are
dummy:
        pop     ax                  ;calculate the address to which
        sub     as, offset
                dummy               ;we will return after the INT
        add     ax, offset pint
        push    ax                  ;(6) push the return address
        and     dh, OCH             ;clear the I and T flags
        push    dx                  ;save this set of flags
        xor     es, es              ;= 0
        mov     bx, [bp+8]          ;get the desired INT number
        shl     bx, 1               ;(4) shift left twice . . .
        shl     bx, 1               ; . . .to multiply by 4
        push    es:word ptr
                [bx+2]              ;get the code segment . . .
        push    es:word ptr [bx]    ;and the offset of the
                                    ;interrupt routine
        call    regsin              ;set up the register
        iret                        ;(2) (5) (7)
pint:
        pushf..., etc.
```

Here is the assembly language code needed to make this happen. The numbers in parentheses in the comments identify which of the steps above is being handled. It should be obvious where this fits in PSYSINT.ASM.

This code can only be understood in the context of the IRET instruction. The routine first sets up the stack as if the INT instruction had been executed. However, this is not enough to cause the transfer of control. It turns out that IRET does precisely steps 2, 5, and 7 by taking the values from the stack. In other words, IRET is the inverse of INT in that it undoes what INT does. Therefore, the routine above "tricks" IRET into performing what it thinks is a normal return *from* interrupt, but which in fact has been set up to transfer control *to* the routine.

Although tricky, the routine is a perfect simulation of the INT instruction, and is also suitable for use in multi-programming environments, since it is re-entrant. For Pascal, the routine is proper. For other languages, it might be necessary to save additional registers, such as ES, DS, SI, or DI.

IBM Images, continued...

There is a tremendous amount of information missing from this section, information which is actually scattered around the book. Worse, the index doesn't have entries that match my terminology for the information for which I was searching. The combination of the manual and some experiments finally taught me what I needed to know, but it took much too long.

The Macro Assembler is okay. I wish the defaults for page length and line width were rational, though. Why is it that so many programs don't allow for top and bottom margins, or a binding margin on the left? A line width of 80 is crazy considering how much space the assembler puts on the left side of each line. Well, it can be fixed as you can see.

The linker seems well-behaved enough. I had a documentation problem again, trying to relate the addresses on the map with the actual load addresses in memory. I was using the linker information in the Pascal manual for a while with no luck. I switched to the DOS manual, and finally found the one sentence that got me off the hook. The reason that map addresses don't match memory addresses has to do with the structure of a .EXE file, the type of executable file produced by LINK. .EXE files are relocated into memory when they are loaded, so the actual memory locations are not known at link time. Unfortunately, there is no tool to help with calculating the correct address from the offset given in the map: it is a manual process. The fact eluding me was the method of calculation.

The final tool, and by far the worst, is DEBUG, the IBM DOS debugger. The program is no help at all for any serious work. The most glaring deficiency is the lack of an assembler so that program changes can be made with source language statements. DEBUG does not handle expressions and does not display data in number systems other than hex. It is not a symbolic debugger, so it does not know anything by name. For example, it is not possible to set a breakpoint at PSYSINT: the absolute address of PSYSINT must be known. Breakpoints are not handled well at all, to the extent that if none are encountered and the program terminates, the breakpoints are left in place. If the debugger knows the program terminated normally, why can't it remove breakpoints? It certainly must know where they are. There are other problems as well.

In summary, the documentation, although complete, seriously complicated my work and caused me to spend much more time than I usually allot for a column. Otherwise the task was straightforward. A serious debugger is much needed.

Listing 3, continued...

```
EXAMPLE OF PSYSINT USE


 J6 IC  Line#  Source Line       IBM Personal Computer Pascal Compiler V1.00
          47   (These routines are some examples of how psysint can be used)
          48
   20     49   procedure CLS [public];
   20     50   begin
 = 21     51       sreg.ah := setmode;
 = 21     52       sreg.al := 2; { -- assumes 80 x 25 monochrome }
 % 21     53       flags := psysint (videoio, sreg, rreg)
   10     54   end;

 Symtab   54   Offset Length   Variable - CLS
               -    2      6   Return offset, Frame length


          55
   20     56   procedure LOCATE (row, col: byte) [public];
   20     57   begin
 = 21     58       sreg.ah := writecursor;
 = 21     59       sreg.al := 0;
 = 21     60       sreg.dh := row;
 = 21     61       sreg.dl := col;
 = 21     62       sreg.bx := 0;
 % 21     63       flags := psysint (videoio, sreg, rreg)
   10     64   end;

 Symtab   64   Offset Length   Variable - LOCATE
               -    6     10   Return offset, Frame length
               -    0      1   ROW                                  :Subrng  ValueP
               -    2      1   COL                                  :Subrng  ValueP


          65
   20     66   procedure CHROUT (row, col, c: byte) [public];
   20     67   begin
   21     68       locate (row, col);
 = 21     69       sreg.ah := writechara;
 = 21     70       sreg.al := c;
 = 21     71       sreg.bh := 0;
 = 21     72       sreg.bl := 7; {attribute -- white on black background}
 = 21     73       sreg.cx := 1;
 % 21     74       flags := psysint (videoio, sreg, rreg)
   10     75   end;

 Symtab   75   Offset Length   Variable - CHROUT
               -    8     12   Return offset, Frame length
               -    0      1   ROW                                  :Subrng  ValueP
               -    2      1   COL                                  :Subrng  ValueP
               -    4      1   C                                    :Subrng  ValueP


CHROUT
```

BIOS Overhead and Video Displays

I mentioned above that the BIOS has a fair amount of overhead. This is both good news and bad news. Let me take a moment to explain my position.

BIOS is written quite conservatively. It appears that little is left to chance, the authors preferring to err on the side of caution. For example, most routines preserve the caller's copy of many registers, more than necessary in some cases. However, doing so isolates a routine and significantly reduces the chance of an error inside one routine doing damage outside its scope. For a piece of software intended for permanency in ROM at the end of a 13-month development project, such conservatism is admirable. Although problems have been found over the last year or so, there has been nothing so severe as to prevent an application from successful implementation. IBM deserves credit for this, especially because of the volume and complexity of code in the BIOS.

The bad news is that the conservatism does tend to create execution overhead, no place more evident than in the video output section. The problem is so severe that use of the BIOS routines for display output cannot keep up with a communications line operating at 9600 bps. Actually, the problem is more a design mistake, forcing the use of routines not well suited for the purpose.

A case in point: the video section provides routines to output a single character, or a single character multiple times. It does not provide a routine to output a string of different characters, obviously a frequent activity. To make this happen, a program must call the BIOS once for each character in the string.

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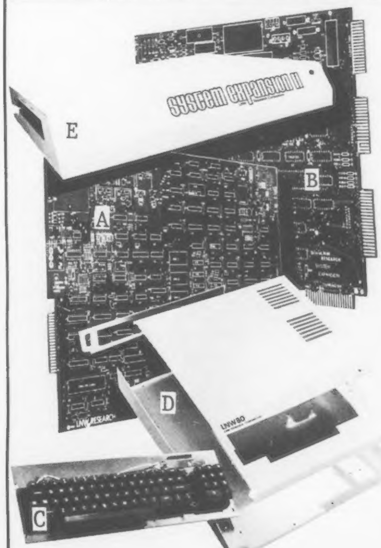

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IBM Images, continued...

The video section is very general. It is possible to call for video output while in any display mode; the program makes all the necessary determinations and acts accordingly. But at what price? Frankly, it is expensive. Sure, all the decisions that have to be made happen in a flash, but how many flashes make up a second? Worse, the display adapter cards behave in a peculiar way that requires the software to wait for certain instants before inserting the character into the memory of the display adapter. Once the instant arrives, there is time to insert several characters, but by BIOS design there is never more than one.

The net result of all this is some surprising slowness from the video section of the BIOS. It is possible to see the difference by ignoring the BIOS and just writing the characters to the display adapter memory. Programs written like that are visually fast, and it is possible to make display pages "snap" in and out. This technique happens to work on the monochrome display, but it creates snow on the display device when used with the color/graphics adapter.

Is there a solution? For the ambitious software developer, yes. Because the routines are all accessed through interrupts (and you thought this part of the column didn't have anything to do with the main theme, eh?), it is possible to replace the video section with code of your own choosing. It is a lot of work, but it is possible. I think this is another of the PC's strong suits. ☐

Listing 3, continued...

```
EXAMPLE OF PSYSINT USE


 JG IC  Line#  Source Line       IBM Personal Computer Pascal Compiler V1.00
          76
          77
          78   (Here is a simple example showing calls to the routines defined above)
          79
   10     80   begin
   11     81       cls;
   11     82       locate (4, 20);
 / 11     83       writeln (output, 'Here is the fourth line.');
   11     84       locate (10, 20);
 / 11     85       writeln (output, 'Here are some graphics characters:');
   11     86       for i := 200 to 210 do
   11     87       begin
   12     88           chrout (12, 20+2*(i-200), i)
   11     89       end;
   00     90   end.

Symtab    90   Offset Length  Variable
                    0     22  Return offset, Frame length
                    2      8  SREG                                  :Record  Public Static
                   10      8  RREG                                  :Record  Public Static
                   20      2  I                                     :Word    Static
                   18      2  FLAGS                                 :Word    Static


             . Errors  Warns  In Pass One
             .      0      0
```

My Favorite Word Processor

Satellite Software finally came through, and I now have a copy of *WordPerfect*, a terrific word processing program. You might remember that I have mentioned this product before, in passing, although I said I had to reserve judgment until I had seen the result of the conversion of the software from Data General to the PC. I shouldn't have worried. As Pete Peterson, the VP of marketing at SSI told me, "Will, it'll be like coming home."

He was alluding to the fact that I use *WordPerfect* on DG gear every day at work. He was right. I did feel right at home. Although function key placement is a little different, I found the new positions relatively easy to get used to.

I was worried that SSI would not make a complete transition from their previous market niche in medium to large systems to the considerably more difficult market arena of the small, personal system. I was primarily concerned about how printers would be handled, because this is the one thing that you can expect to be different from system to system. The success of *WordStar* is due in large part to its ability to configure for almost any imaginable system. Well, not only does *WordPerfect* support a wide range of printers, it also handles two at a time, prints in the background, and can maintain a queue of print requests rather than just one. Both the parallel and serial ports are supported. Furthermore, printer control codes can be embedded in the text at any position to get at features not directly supported by *WordPerfect*.

The two major print enhancements, bold and underscore, are directly supported by the system. They show up on the screen, and they can be done on virtually any printer. *WordPerfect* goes one step further for the Epson printer, something I really like: for those equipped with Graftrax, italics can be printed just by selecting a different built-in font.

I like this package so much that I may come to regret my prime directive of word processor evaluation: use the evaluation product for one major piece of work before reviewing it. That means I won't be able to use *WordPerfect* all the time. Rats. Not to worry, though, I'll still retain my objectivity. But I do get to have a favorite, don't I?

Well, to be honest, there are a couple of disappointments. The first is that SSI's super help feature on DG is not carried over to the PC implementation. For DG, you press the help key followed by another keystroke. *WordPerfect* then tells you what you need to know about the function of that key. For the PC, the help key gets you an alphabetical list of the functions, the key to press to obtain the function, and the page number in the manual that describes the function. It's not too bad, but it's also not as powerful or as helpful as the original. SSI told me that space limitations were the culprit, but coming from them I was surprised to hear it. For DG, their stock in trade has been their ability to deliver a full-function word processor in a very limited amount of space.

The other disappointment is that the program requires a little more than 64K of main memory. SSI says they are working on making it fit. Again, they are well known for their compact implementations for DG. I don't expect this to be a problem because the majority of machines sold to businesses have more than 64K of main memory, and expanding to be able to use this software is hardly a painful thing to do. It might restrict consumers at the low end, however.

The program costs $495 and includes the SSI merge feature, a complex but useful math mode, and an easy-to-use column feature. A dictionary option will be available soon at additional cost—around $100 I think.

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rings...trs-80 strings...trs-8

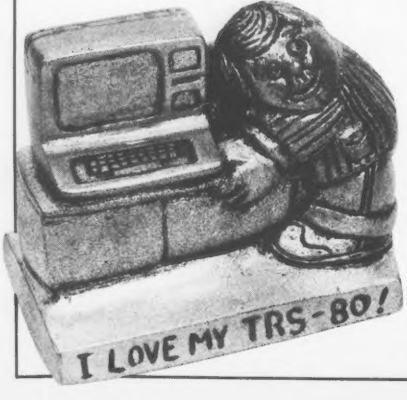
Stephen B. Gray

The old Forty-Niner dipped his Tandy pan into the Texas creekbed and came up with flecks of gold: a TRS-80 sculpture, Radio Shack's *Audio Spectrum Analyzer* plug-in program for the Color Computer, a book on TRS-80 graphics, Tandyvision One, a comment on Color-Computer hi-res, and a short program that draws a four-way doodle under your control.

TRS-80 Computer Scultpure

For $9.95 you can buy, postpaid, a paperweight and/or conversation piece that is, according to the press release, "a contemporary caricature of the popular TRS-80 and a happy user" (Figure 1).

Figure 1. One of the half-dozen computer sculptures offered by Brian Productions resembles the Radio Shack TRS-80 Model III.



This sculpture of a Model III and a computernik with no neck and not much torso (for $9.95 you were expecting Michaelangelo?) is an "antique gold-finished plaster statue . . .a hefty $4^1/_2$ inches long." Ten or more are $7.95 each, from Brian Productions, 2949 Southfield Rd., Xenia, OH 45385.

Brian told me the sculpture is plaster of paris (so don't drop it), which he has cast commercially in quantity and then sprays black and gold himself. He's been selling such sculptures for ten years, starting with an NCR Century. He also sells similar sculptures of the Apple, IBM System/3, IBM 370, a plain unnamed computer (which looks somewhat like an old IBM 360), and another labelled, "I hate my computer," which resembles nothing at all.

Audio Spectrum Analyzer

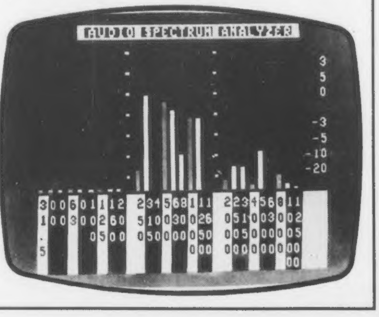
Although Radio Shack's $19.95 plug-in *Audio Spectrum Analyzer* Program Pak for the Color Computer is described in the catalog as "the perfect way to test your stereo equipment for maximum performance," it's quite entertaining just to watch the vertical bars dancing like a colorful fountain in response to the music.

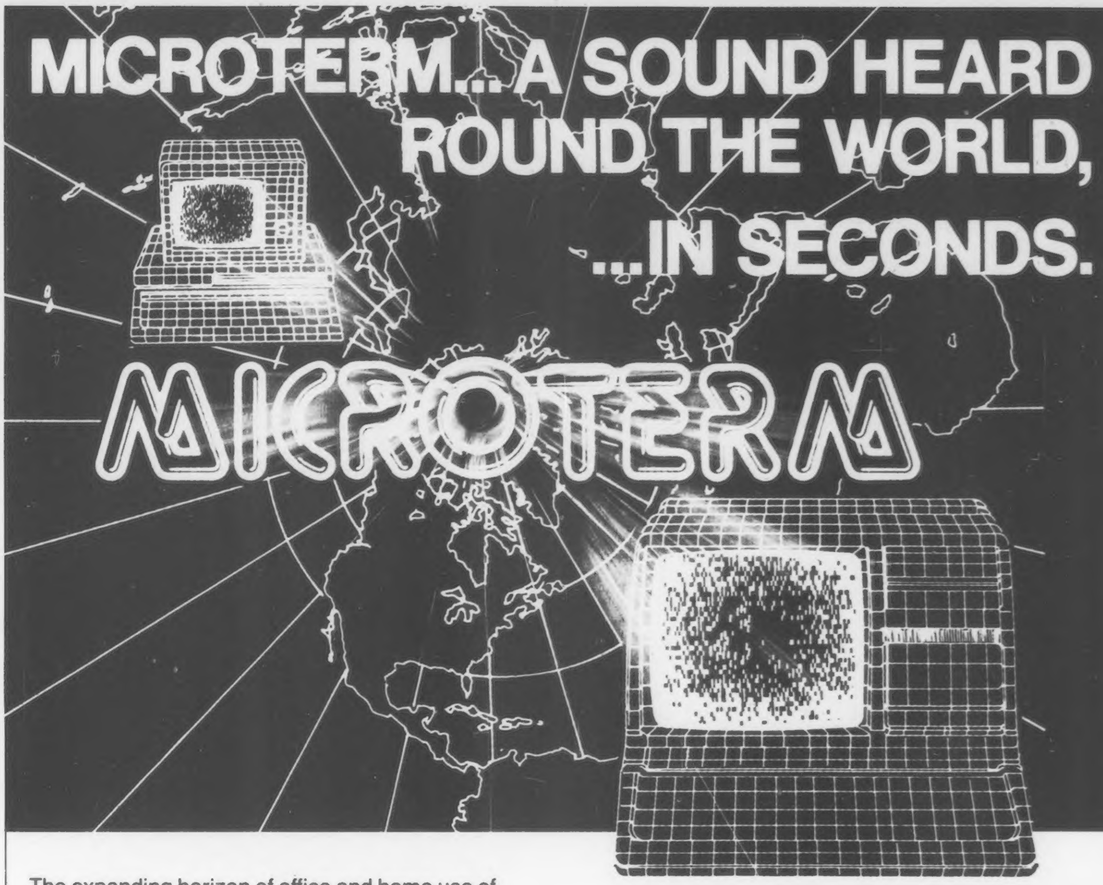
First you connect your stereo amplifier to the Color Computer by patching the headphone output of the amplifier to the black plug on the cassette recorder that normally goes into the EAR jack, using a connector that has a quarter-inch stereo jack on one end and an eighth-inch miniplug on the other. With the other end of the cable plugged into the computer, and the program ROM cartridge inserted in the right-side slot, all you do is turn on the stereo and the computer, and soon you see a very colorful display (Figure 2) of 27 vertical bars that represent one-third-octave segments of the nine-octave range from 31.5 Hz to 12,500 Hz.

The vertical color bars are calibrated in dB, which is a relative measurement; the program locks onto the loudest one-third-octave present and scales its measurements from that reference.

As you watch, you learn about the characteristics of various types of music,

Figure 2. The energy distribution of music or speech is displayed as vertical color bars a third of an octave part.





The expanding horizon of office and home use of new communications and data services tying smart terminals into networks through telecommunications links makes the world need a high speed terminal program.

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CIRCLE 212 ON READER SERVICE CARD

and before long you might even be able to identify with the sound turned off classical music, rock, and jazz. Press the K key, and you get an "audio kaleidoscope" that produces changing visual images that depend on the distribution and intensity of the audio signal. At first the pattern seems truly random, but after a while, you learn to differentiate between various types of music. Even noise has its own pattern.

The color bars that represent the instantaneous energy distribution display the real-time peak response. Press S to get the averaging Slow RMS response, for measuring the effect of speaker placement or tone adjustments.

Measuring power is difficult, because the peaks pass quickly. You can lock onto the highest peak level reached in each band by pressing P to show the Peak levels in the signal. In Fast mode, you see which frequencies demand the most power; in Slow mode, the average distribution of the signal and the general relative response of the system under test.

To freeze the display for analyzing a musical passage or an instant in time, just press the space bar.

Measuring the Electronics

Put a familiar record on your turntable, set the tone-altering controls to flat response, set *Spectrum Analyzer* to Slow response with the Peak display turned off, and play the entire selection. Adjust the amplifier volume to show maximum activity on the screen.

Then replay, in Peak Hold mode. At the end of the selection, the Peak indicators show the maximum average energy reached in each band. You can now play the record again and use your tone controls or graphic equalizer to change the sound, and see their effects on the music by comparing the new peaks to the original peak indicators.

Measuring the Audio Chain

By connecting *Spectrum Analyzer* to a low-powered amplifier driven by a microphone, you can measure room and speaker response. Try the microphone in various parts of the room, and use your tone controls and/or graphic equalizer to try to match the response achieved in the flat-response test from the headphone output jack.

TRS-80 Graphics—With Disk

One of the best books on TRS-80 graphics is called just that: *TRS-80 Graphics: For the Model I and Model III*, by David A. Kater and Susan J. Thomas. Published by Byte/McGraw-Hill at $12.95, it is also available in a Radio Shack cover for $10.95 at Radio Shack stores.

```
10 CLS: INPUT "ANGLE BETWEEN POINTS IN DEGREES"; D
20 INPUT "POINTS (P) OR LINES (L)"; S$
30 CLS: X1=64: Y1=24
40 PRINT D "DEGREES": E=D/57.296: SET(64,24)
50 IF S$="P" THEN PRINT "POINTS" ELSE PRINT "LINES"
60 FOR A=0 TO 200 STEP E
70 X=A*COS(A)+64.5: Y=A*SIN(A)*.43+24.5
80 IF X<0 OR X>127 OR Y<0 OR Y>47 THEN 210
90 IF S$="P" SET(X,Y): GOTO 200
100 IF X1<>X THEN 130
110 IF Y1<Y THEN S=1 ELSE S=-1
120 FOR Z=Y1 TO Y STEP S: SET(X1,Z): NEXT Z: GOTO 200
130 M=(Y-Y1)/(X-X1)
140 IF ABS(M)>1 S=ABS(1/M) ELSE S=1
150 IF X1>X THEN S=-S
160 FOR Z=X1 TO X STEP S
170 SET(Z,M*(Z-X1)+Y1)
180 NEXT Z
190 X1=X: Y1=Y
200 NEXT A
210 FOR I=1 TO 3000: NEXT
220 IF INKEY$=" " THEN 10 ELSE D=D+1: GOTO 30
```

Listing 1. Spirals.

The book covers all the basics such as SET and RESET, strings, PEEK and POKE, and machine language graphics and sound, then gets into geometric shapes and function plots, statistics, graphs, games, kaleidoscopes, plotting art, etc. Animation is explained by using an eye-blinking and antenna-twitching beast called Critter. (If several of the graphics examples look slightly familiar to those of who have been reading this column for a while, it is because *Creative* is one of the places the authors looked for ideas, and then improved upon what they found.)

On the last page in the book, the authors (whose address is Box 1868, La Mesa, CA 92041) offer a cassette or disk containing 35 of the major programs, for $14.95. This is highly recommended if you hate to key in programs.

The 35 recorded programs are meant to be used in conjunction with the book, mainly to save you time in typing and correcting program errors as you go through the text, and thus "speed up your learning." The authors want you to run a program, think about what you see, read the line-by-line analysis, then go over the program to make sure you understand what makes it work.

Most of the programs display graphics that don't do anything other than show a graph, plot, sample menu, dragon, or lion's head, which is all the text calls for. But several do something other than just show a static display. One is Sketch; you use the arrow keys to draw whatever you like, in white on black or vice-versa, with counters keeping track of where the cursor is. Inkblot automatically draws a randomly-generated four-way kaleidoscopic pattern, by using the arrow keys (see the Short Program at the end of this column).

Spirals

Another active program is Spirals, from the section on circular graphics, using polar coordinates to create one new spiral after another, by increasing the angle of rotation for each new display.

You enter D, the "angle between points in degrees" (line 10) and indicate whether the spiral is to be drawn as a continuous line or as points (line 20). The spiral is begun at the center of the display by the SET in line 40.

The equation for the spiral is in line 70; additives 64.5 and 24.5 keep the spiral centered in the display; the .43 factor compensates for the 3:7 aspect ratio of the rectangular graphics block (how?). When the spiral reaches the edge of the display area, line 80 stops the drawing, jumps the program to a time delay in line 210, and after several seconds the next spiral is drawn, with D augmented by 1, which increases the angle between the points and thus draws a different spiral, some of which look rather odd.

Note that if the spiral is drawn as points, line 90 skips over half the program. Can you figure out how lines 100-190 are used to draw the spiral as made up of line segments?

For ordinary spirals, try a value for D such as 3, using P or L. For something quite different, use angles such as 88 or 122 degrees, first with lines, then with points. Notice the big difference in the appearance of spiral displays when using lines or points, when the angle is between 60 and 90. Why is this? Note how the spiral smooths out, using lines, when the angle increases from 315 toward 340 degrees.

To remove the delay between finishing one spiral and starting the next, replace the delay in line 210 with REM (why not just delete the line?). To increase the

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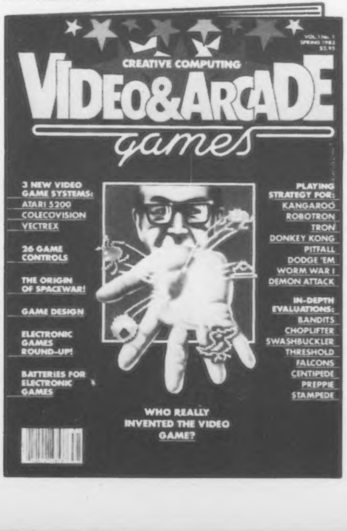
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speed of generating spirals, so you can more quickly see the effect of using various angles and either lines or points, reduce the 200 in line 60 to 25 or even 20 (after writing 210 REM).

When the program reaches line 220, it increases the value of D by one and jumps to line 30 to draw the next spiral automatically. But if you want to change the variables, press the spacebar, and when the current spiral is finished, the program jumps to line 10.

Note the difference between the "spiral" drawn with lines when D is 90 and when D is 90+360, or 450. Why are these spirals different?

Tandyvision One

Radio Shack's new $249.95 computer-based electronic video game, Tandyvision One, is a custom-labelled Mattel Intellivision. According to the press release, "it can run all Mattel Intellivision and Sears Super Video Arcade cartridges." The game comes with *Las Vegas Poker* and *Blackjack*; 15 Intellivision cartridges are available through Radio Shack stores and dealers, ranging from $17.95 for *Checkers* to $34.95 for *Sea Battle* or *Star Strike*. Additional Intellivision game cartridges are available through Radio Shack's special ordering service, the "Intellivision Cartridge Hotline."

The 16-bit, microprocessor in Tandyvision One controls sound effects, music, color and high-resolution animated graphics.

Intellivision has been available at Macy's in New York for $229.95 less a $50 rebate, for a "final cost" of $179.95.

Color-Computer Hi Res

Arnold Kahn writes from Chevy Chase, MD:

"I have followed your column with particular interest in matters relating to the TRS-80 Color Computer. I noted your comments on high resolution on the 4K machine, in the March 1982 issue." (Page 202 includes a program that accesses the hi-res mode without Extended Basic, and asks if anybody had figured out how to access the mode fully in the same way.)

"A careful reading of the Radio Shack introductory manual shows that a full screen at highest resolution requires 6K of RAM for the display alone. Since the 4K machine doesn't have it, there is no way to put up a full screen of high-resolution material. Also, because of the VDG-SAM (video display generator-synchronous address multiplexer) architecture, it is not possible to divide the screen into a graphic part and an alphanumeric part, the way some machines allow.

"The best route for the 4K owner is to upgrade the machine to 16K with his own two hands. It is easy. The cost these days is about $16 for eight 4116 200-nsec memory chips to replace his eight 4027 chips. He'll need to see the Radio Shack Technical Manual for the Color Computer (which he should have anyway) or compare with a 16K machine. In addition to replacing the socketed chips, the owner must move two jumper plugs that are clearly marked. No soldering is required. The machine will then have 16K memory, and will be the best bargain-priced computer in the world. (It will not have Extended Basic, and the warranty will be dead.)

"Upgrading to 32K by piggybacking chips is possible, but it takes soldering. A 32K upgrade without soldering is in the form of a plugboard from Computerware.

```
10 CLS: DEFINT A-Z
20 X=0: Y=0
30 P=PEEK(14400)
40 I=P AND 96: J=P AND 24
50 H=SGN((I-63)*I)
55 K=SGN((J-15)*J)
60 IF X+H<0 OR X+H>127 THEN 30
70 IF Y+K<0 OR Y+K>47 THEN 30
80 SET(X,Y): X=X+H: Y=Y+K
90 SET(X,Y): SET(127-X,Y)
100 SET(X,47-Y): SET(127-X,47-Y)
105 IF P=1 I$=INKEY$: GOTO 130
110 RESET(X,Y)
120 GOTO 30
130 I$=INKEY$
140 IF I$="" THEN 130 ELSE 10
```

Listing 2.

"Extended Basic comes in a plug-in ROM, but costs about $100, if you can get it. It is worth having for the editing capability alone, but then the cost is almost up to that of buying the machine fully equipped." The Computerware memory board for expanding from 16K to 32K, which I haven't seen, is $79.95 plus shipping, from Box 668, Encinitas, CA 92924. They have a catalog of products for the Color Computer.

Short Program #37: Four-Way Doodle

Going back to the *TRS-80 Graphics* book, let's look at the doodle program in Listing 2.

You use the four arrow keys to move a blinking cursor left or right, up or down, and as you do so, the pattern you create is duplicated, in mirror fashion, in the other three quadrants, so the total effect is that of a four-way kaleidoscope. The pattern begins in the four corners, as initiated by line 20. Because the cursor can move anywhere on the screen, it may cross over into another quadrant. But you have only to look for the blinking cursor to locate what might be called the "master quadrant," the quadrant to concentrate on.

Press two arrow keys (such as the up and right arrows) simultaneously, and the pattern line will be drawn at an angle. When you're through drawing, press ENTER, and the cursor will stop flashing.

Line 30 tests location 14400 to see if it contains a value other than zero. The Radio Shack manuals are rather vague on what values will be stored in location 14400 when the arrow keys are pressed. You can find out easily enough by using this short program:

```
10 PRINT PEEK (14400);
20 GOTO 10
```

and while it is running, press any of the four arrow keys. You will soon see that the arrows put these values in location 14400: up, 8; down, 16; left, 32; right, 64.

Lines 40 and 50 "show a compact way

"...charming, attractive, witty; she's even kind to plants and animals. But if a gal can't hang ten on the computer wave, I say it's time to review the relationship."

to determine which of the arrow keys have been pressed," the book says. "The sign function is used in line 50 to determine an increment of -1, 0, or +1 for X and Y, P AND 96 is stored in I in line 40. The AND is used to mask out everything except 32 and 64 which represent the left and right arrows, respectively. If I is zero, neither the left nor the right arrow key was pressed, so H becomes zero. If I is 64, H will be +1, and if I is 32, H will be -1. K is calculated similarly. P AND 24 is stored in J. The AND tests for 8 and 16, which are returned by the up and down arrows. Then K is determined by -1, 0 or +1."

If that is not clear, it is partly because some is developed previous to that point in the book, and partly because the authors seem to take it for granted you will understand the Boolean algebra in line 40. Yet the Radio Shack manuals are very skimpy on Boolean: the Model III Basic manual provides one chart that is almost meaningless in its brevity; the Level II manual has almost the same chart, plus ten examples that are more mystifying than helpful because they are not explained thoroughly enough.

If the left arrow has been pressed, P will be 32. If we AND this value of P together with 96, we get

```
96 = 1100000
32 =  100000
      100000 = 32
```

If the right arrow has been pressed, then P will be 64, and if we AND this together with the same 96, we get

```
96 = 1100000
64 = 1000000
     1000000 = 64
```

Both examples show that if you AND a 1 with a 1, you get a 1, but if you AND a 1 or a 0 with a 0, you get a 0. Because 96 is the sum of 32 and 64, a single AND expression using 96 can test for both values to determine if the left or right arrow has been pressed.

If either has, then I is 32 or 64 (line 40) and H is -1 or +1 (line 50). If no arrow key has been pressed, then P is zero, I is zero, and H is zero.

The same logic operates for the up and down arrows, in the second halves of lines 40 and 50, to decide whether K will be -1, O, or +1.

If adding the values of H or K to the X-Y position of the cursor means the cursor will touch the boundaries of the graphics area (X between 0 and 127, Y between 0 and 47, inclusive), line 60 or 70 causes the program to jump back to line 30 to wait for you to press an arrow key that moves the cursor away from (or along) the boundary. Otherwise the values of H and K will be added to the X-Y position of the cursor, and lines 80-100 will add pixels in each quadrant in accord with which arrow keys are pressed.

When you are "done with your creation, press ENTER. The cursor will stop flashing so that you can admire your work. Then, any key will clear the screen and start the program again," the book says.

When you press ENTER, P becomes a 1, as you will find if you run the two-line program and press ENTER. Line 105 will then cause the program to jump to line 130, skipping over the RESET in line 110 that causes the cursor to blink, thus stopping the blinking and putting a hold on everything until you press any key, which causes a jump to line 10, to clear the screen and restart the program.

If all that was easy, then you might try answering these questions: 1) What is the value of P when two arrow keys are pressed simultaneously? 2) What happens when you press both the left and right arrow keys simultaneously? 3) Does one of those two keys have precedence, and why? 4) What does the DEFINT in line 10 do for the program? ☐

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Steve Gray

Minds and Mechanisms: Philosophical Psychology and Computational Models, by Margaret A. Boden. Cornell University Press, Ithaca, NY. 317 pages, hardcover $29.50. 1982.

This collection of essays is by a professor of philosophy and psychology at the University of Sussex (England) who also wrote *Artificial Intelligence and Natural Man*. In this latest book, she "presents an interdisciplinary study of our mental representations of the world and their transformations that mediate our thinking, action and experience," according to the dust jacket.

Boden "addresses four closely related questions: What is the nature of the mind, and of specific mental phenomena, such as intention, reasoning, choice, or repression? What sorts of concepts are required for an adequate theoretical psychology? How is it possible for the mind to be embodied? And what is the relation between psychology, on one hand, and physiology or biology on the other? Boden adopts a computational approach to these questions, claiming that the concepts and insights of computer science and artificial intelligence are useful in describing and explaining psychological processes."

The book "will interest both philosophers and cognitive scientists," the dust jacket continues, after noting that Boden "shows that the computational metaphor stresses features of the human mind—such as purpose and subjectivity—which many psychological theories have ignored or even denied."

The 13 essays are divided into four parts: Explanation and Computation (The Computational Metaphor in Psychology, The Case for a Cognitive Biology, etc.), What We Have in Mind (The Structure of Intentions, Real-World Reasoning, Implications of Language Studies for Human Nature), Psychologists Ancient and Modern, and Values and Psychological Theory (Human Values in a Mechanistic Universe, Optimism).

For most readers of *Creative*, this book will seem more or less like a collection of intellectual trivia. For the remaining few who enjoy (and understand) sentences such as, "This morphological-behavorial continuity presumably involves biological clocks as organizing principles, since these are basic to the spatio-temporal organization of embryogenesis," there are many more such phrases. There are some interesting passages, but they are few and far between in what seems to be essays written by one PhD for other PhDs.

TRS-80 Color Programs, by Tom Rugg and Phil Feldman. Dilithium Press, 11000 S.W. 11 St., Beaverton, OR 97005. 348 pages, paperback $19.95. 1982.

Although the price for this paperback seems high, it contains 37 programs, which works out to about 54 cents each; rather cheap, even if you do have to enter them via the keyboard.

The title is somewhat misleading, because very few of the 37 programs require color. The subtitle, which is printed only on the inside pages, is more helpful: "Programs for Color Basic and Extended Color Basic on the TRS-80 Color Computer."

The 37 programs are divided into six sections: Applications (Biorhythm, Checkbook, Mileage, Sortlist, etc.); Educational (math drill, metric tutorial, vocabulary drill, etc.); Games (Roadrace, Wari, Obstacle, etc); Graphics Display (kaleidoscope, sparkling patterns, overlaying concentric squares, etc.); Mathematics (least-squares curve-fitting, simple graphs, integration, simultaneous linear equations, etc.); and Miscellaneous (approximating pi, powers, Pythagorean triplets, play music, etc.).

Three of the graphics programs require color for their effects, and color does enhance most of the games as well as many of the other programs. One very nice feature is a center section with 15 full-color displays of a dozen of the programs. This adds to the cost of the book, but does give you a chance to see exactly what the displays look like; this is one of the *very* few Color Computer books that show some displays in color.

Not everybody will be delighted by the mix of programs, many of which the average Color Computer user would seldom if ever use. However, a great deal can be learned from this book, because each program is fully documented, with sections on Purpose, How to Use It, Sample Run, Program Listing, Easy Changes, Main Routines (groupings of program lines), Main Variables, and Suggested Projects (more extensive modifications and extensions).

The writing is a little stiff and sometimes wordy, but it does explain the program in fine detail. This is the book to get if you've been having trouble finding programs for your Color Computer. And even if you use only half a dozen of the 37, that's still only $2 each.

By now cassettes of the programs should be available: one cassette for each of the six sections of the book, at about $12.95 each.

Introduction to 8080/8085 Assembly Language Programming, by Judi S. Fernandez and Ruth Ashley. John Wiley & Sons, New York. 314 pages, paperback $8.95. 1981.

Written by the team that also authored two other Self-Teaching Guides for Wiley, "Job Control Language" and "Using CP/M," this is another assembly-language book that is best understood if you already have some knowledge of the subject.

By page 12, the authors have introduced registers and flags, without having provided enough background for the beginner to know what they're for. As with other books in the STG series, this one is also divided into frames, which are "short sections in which information is presented or reviewed, followed by questions which ask you to apply the information," according to an early page. So you get a lot of drill, but unless you already have some background in assembler you'll be learning by rote until it all begins to hang together (if indeed it all does). Perhaps then you can shuffle the various sections around in your mind, and mentally backtrack to reconsider the material you originally took on faith, but not many people can perform such mental feats. It is easier to read the book twice.

The first chapter, an introduction, gives some general material on assembler, goes briefly into bits and bytes, and then on page 8 presents registers, for the first time, without any previous text leading up to A, B, C, D and the other

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registers. This is no problem if you know something about registers, but if you don't, you'll probably be rather confused, because there are no drawings or charts to help explain what registers are.

Chapter two is on Number Systems and Data Representation, and is written very clearly and simply with plenty of drill work. Then you get hit with chapter three, on Instruction Format, which is bound to mystify the beginner all over again, with a lot of "what" but almost no "why."

Most of the material required to make a good book for those with some knowledge of assembler is here, but not in the right order. The authors seem to have little sense of how to move gradually from the simple concepts to the more complex ones, and instead mix them together. This is one of the very few Wiley books that miss the mark.

DON'T (Or How to Care For Your Computer), by Rodnay Zaks. Sybex, 2344 Sixth St., Berkeley, CA 94710. 232 pages, paperback $11.95. 1981.

This may indeed be, as the press release claims, the first book that "explains how to handle and maintain all components of a computer system: the computer proper, the CRT display, the diskettes, the printer, the magnetic tapes."

Since such information, at the personal computer level, could hardly fill 232 pages, much of the book is taken up with describing what computers and peripherals are, and how they work. After a very general chapter on computer care, and another that gives a fast run-through on what a computer system is, we learn how to treat floppy disks with tender loving care, in 36 detailed pages that cover just about everything on the subject.

Then we learn what (and what not) to do with hard disks, the computer, CRT, printer, and tape units, with detailed information on preventing damage, cleaning, temperature and power problems, maintenance, etc. The last few chapters are more general, on the computer room (floor planning, electrical power, fire protection, etc.), software, documentation, security, and help (maintenance). An appendix lists tape and disk manufacturers.

Much of the information is of the common-sense type, but of course many of us are sometimes guilty of ignoring some of the simplest rules. Most computerniks can learn much from this book, especially those just getting into disk drives. The chapter on floppy disks alone may well be worth the $11.95 to those who might easily cause expensive damage to their drives without even half-trying.

The writing is simple and direct, and the book provides much useful information in addition to the how-to-care-for details.

The Guide to DP Training Courses: Descriptions of Over 300 Programs and Workshops, edited by Jocelyn W. Franklin. Human Resource Development Press, 22 Amherst Road, Amherst, MA 01002. 364 pages, looseleaf in three-ring binder, $95 including two future supplements. 1982.

According to the accompanying letter, this "unique reference book" will "enable DP managers and trainers to compare costs, content and objectives for hundreds of training programs."

views...book

More than 350 training courses, seminars and workshops are divided into nine major areas, such as applications, programming, systems analysis, systems design, databases, management skills, and others. Each page-long description includes information on audience (such as "beginning programmers"), course objectives (such as "understand database calls, code IMS batch programs"), course topics, delivery system (length of course, number of participants, hours per day), cost, and contact.

Two indexes are provided, one by subject, the other by vendor. Also included is a list of additional vendors offering courses about which information wasn't received in time for this volume; many of them will be included in the two supplements.

The mix includes a great variety, such as database fundamentals, VASM for Cobol programmers, DP project management structured test plans, RDOS system programming, digital PABX, personal computers for business, active listening skills, and computer auditing, to pick one from each of the nine sections of the book.

This may be the only publication of its kind, and although it obviously can get out of date quickly, seems well worth the money if you are looking for information on DP training courses.

The Basic Conversions Handbook for Apple, TRS-80, and PET Users, by David A. Brain et al. Hayden Book Co., Rochelle Park, NJ. 86 pages, paperback $7.95. 1981.

Written by a New Hampshire group of four called the Brain Bank, this is a guide to converting "a Basic program for TRS-80, Apple II, or PET into the form of Basic used by any other one of those machines.... Also described are variations in graphics capabilities, PEEK, POKE, and CALL statements, cursor and control characters, memory locations, etc.," the back cover says.

A three-page chapter on Methods of Translation is followed by the three main chapters, on converting into one of the three Basics. Each of the three chapters is divided into two parts on converting from one machine into the particular Basic. That means six separate sections, each four to 24 pages long.

The shortest section is on translating PET into Apple II, and mostly consists, like the rest of the sections, of a long list of PET commands with equivalent Apple II commands. Many are identical (all three machines use Microsoft Basic), some require changes, and a very few have no equivalent. A brief paragraph on graphics notes that "The PET has a built-in character ROM for various graphics characters....to compensate for this feature, you must create your own graphic version of the symbols provided on the PET." Charts at the end of the book give "screen coordinate conversion" from one computer to another (as well as information on subroutines and sample program conversions).

This book gives the simplest conversion information, and as such is simple and fast to use. More details are given in the $10.95 Dilithium book by Larry Noonan, *Basic Basic-English Dictionary for the Apple, Pet, and TRS-80.* This book provides an alphabetic listing of commands, and shows how each is implemented in the three computers. However, you have to figure out how to make the conversions. Take your choice: fast conversion or more details. ☐

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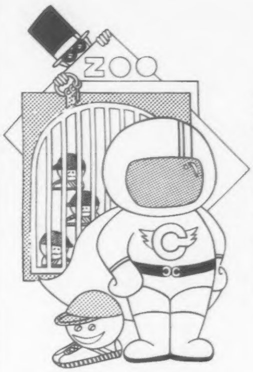

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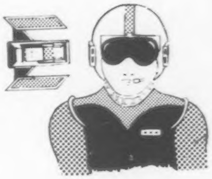

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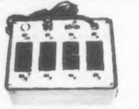

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index to advertisers

Reader Service No.	Advertiser	Page
101	Aardvark	223
102	AB Computers	71
103	Abacus	270
104	ABC Data Products	300
*	Accent Software	88
105	Adventure International	153
*	ALF Products	119
106	Amdek	56-57
107	American Small Business Computers	239
108	Apple Computer, Inc.	78-79
109	Appleware, Inc.	269
110	Ark Computing	217
*	Artworx	87
*	Aspen Software	159
111	Atari	76
112	Atari	171
113	BASF Computer	39
114	Beagle Brothers	243
115	Big Five Software	13
116	BMC/USA	224
*	Bottom Line	255
117	Broderbund Software	11
118	BT Enterprises	54
119	Business Solutions, Inc.	134
120	Bytewriter	148
121	Cab-Tek	275
122	Calsoft	221
123	Carolina Micro	269
125	Check-Mate	277
126	Chrislin Industries	53
127 &128	C-Load Magazine	113
129	Collins International Trade	164
130	Commodore Business Machines	111
132	CompuServe	150-151
133	Computer Advanced Ideas	27
134	Computer Discount of America	283
135	Computer Discount Products	107
136	Computer Exchange	94-95
137	Computer Learning Tree	227
138	Computer Mail Order East/West	24-25
139	Computer Outlet	114-115
140	Computer Plus	273
141	Computertime, Inc.	228
142	Computer Warehouse	277
143	Computronics	C3
144	Comstar	271
145	Consumer Computer Mail Order	271
146	Continental Software	185
147	Continental Software	259
148	Cosmic Computers	19
152	Cottage Software	76
150	Covercraft	165
151	CPU Shop	131
157	Data Impact Products, Inc	287
153	Datamost	31
154	Datamost	84
155	Datasoft	98
156	Davidson & Associates	251
	DDL Software, Inc.	229
159	Dickens Data Systems	76
*	Digital Equipment Corporation	46-47
158	Dresselhaus Computer Products	212
160	Dynacomp	261
161	Edu-Ware Services	125
162	Electronic Protection Devices	196
163	Electronic Specialists	275
164	Epson America	142-143
165	EPYX	33
166	EPYX	154
167	Floppy Disk Services	5
168	Franklin Computer	43
169	FROBCO	255
170	General Technology	166
171	General Videotex	203
173	Genie Computer	157
179	Great Plains Software	199
173	Happy Hands	10
174	Hayden Book Company	129
175	Hayden Software	178-179
178	Hayes Microcomputer Products	83
180	Hewlett-Packard	49
181	Huntington Cumputing	241
182	IBM Corporation	40-41
184	I.J.G. Computer	109
183	I.J.G. Computer	302
*	Infocom	62-63
185	Integral Data Systems	127
186	I/O Management	281
187	Ironsides Computer Corporation	245
188	Jade Computer Products	121-123
189	JRT Systems	45
190	Kensington Microware	247
191	Kybe	147
192	L-Com, Inc.	283
193	Leading Edge	9
194	Leading Edge	Cov 4
195	Learning Tools, Inc.	191
196	Lightning Software	259
289	Little, Brown and Company	271
197	LNW Research	21
198	LNW Research	291
199	Lyco Computer	293
200	Marco Polo Company	253
201	Marymac	291
202	Micro Business World	235
203	Micro Computer Technology	213
219	Micro D	17
204	MicroHouse	186
205	Micro Lab	167
223	Micro Learningware	192
206	Micro Management Systems	184
207	Micro Merchant	117
208	Micromint	273
209	Micro Peripheral, Inc.	173
210	Micro-Systems	273
211	Micro Systems Exchange	206
212	Micro Systems Software	295
213	Micro-Ware Distributing	275
214	Micro Works	281
124	Monument Computer Services	239
216	NEBS Computer Forms	251
215	NEC Home Electronics	37
248	NEC Information Systems	73
217	NEC Information Systems	138-141
230	NEC Information Systems	183
220	NEXA Corporation	303
*	NRI Schools	113-115
218	Odesta	145
221	Okidata	75
222	Omega Microware	207
237	Omega Microware	299
*	Omega Sales	263
225	Pacific Exchanges	192
225	Pacific Exchanges	206
225	Pacific Exchanges	229
225	Pacific Exchanges	254
226	Penguine Software	189
227	Peripherals Unlimited	301
234	Perry Oil & Gas	251
288	Practical Peripherals	1
285	Program Design, Inc.	208
231	Programmer's Institute	237
232	Prometheus	190
233	Protecto Enterprises	266-267
235	Qantex	28
236	Quadram Corporation	205
238	Quality Software	92
239	Quick-N-Easi Products	220
286	Qume	200-201
240	Radio Shack	65-70
241	Radio Shack	163
243	RCE	209
242	RCE	239
260	Reader's Digest	10
244	Red Baron	218
245	Remarkable Software	277
246	R.H. Electronics	176
247	R.H. Electronics	177
229	Rock-Roy	2
249	Roklan	91
250	Royal Software	269
251	Satellite Software International	149
252	SFA Enterprises	229
253	Sierra On-Line, Inc.	58
254	Sierra On-Line, Inc.	158
268	Sirius Software	35
269	Sirius Software	77
255	SJB Distributors, Inc.	100
256	Softsync	254
257	Software Management Group	268
276	Software Publishers	212
258	Software T'Boot	271
259	SOURCE EDP	230-231
261	Spectravideo	C2
262	Spectravideo	80
*	Spinnaker Software	14-15
290	Standard & Poors	279
263	Strategic Simulations	175
264	Street Electronics	86
265	Strictly Software	244
275	Sub Logic	130
266	Sweet Microsystems	160-161
270	Symtec	10
271	Synetix	211
272	Systems IV Limited	133
273	Tactical Design	270
278	Tech Data Corp.	254
274	Tecmar	7
277	TG Products	195
279	Think Software, Inc.	71
280	Tyrant Software	192
281	Val Par International	22
284	Videx	137
282	Xerox Education Publications	97
283	Zebra Computer Products	159

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